

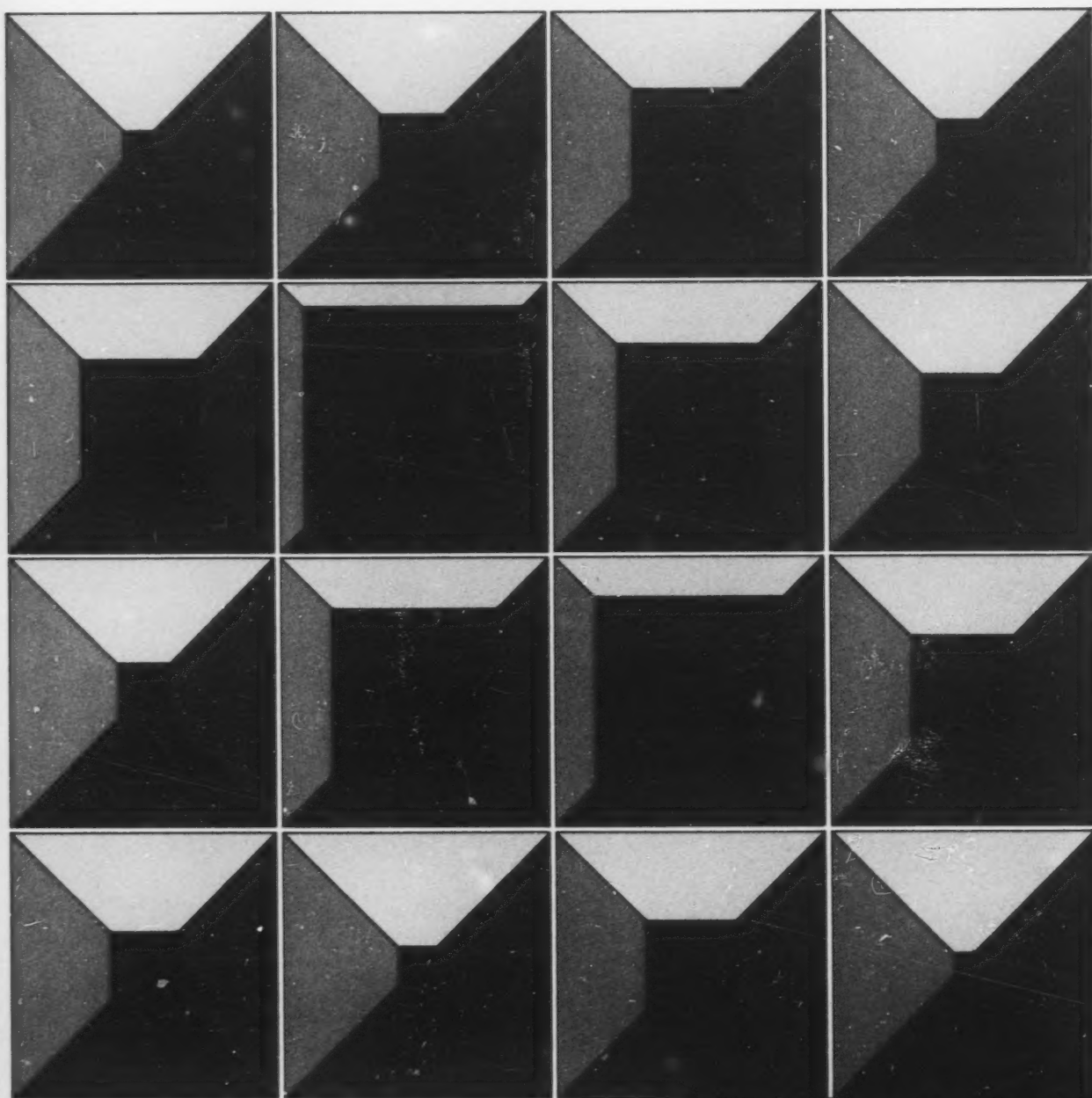
A CBO STUDY

Understanding Natural Gas Price Decontrol

April 1983



Congress of the United States
Congressional Budget Office



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UNDERSTANDING
NATURAL GAS PRICE DECONTROL

The Congress of the United States
Congressional Budget Office

PREFACE

In 1978, the Congress passed the Natural Gas Policy Act (NGPA), which allowed the wellhead price of much of the nation's gas to rise to levels suggested by the then-assumed future price of oil, and to be decontrolled in 1985. The oil price assumptions that underlay the NGPA's gas price paths, however, proved to be substantially lower than the prices that materialized. This and other features of both the NGPA and natural gas markets have made the smooth transition to decontrol imagined in the act unlikely. These effects, coupled with the expiration of NGPA controls in 1985, have led many in the Congress to reconsider the nation's long-term pricing policy for natural gas at the wellhead.

A variety of analyses concerning the natural gas market and the economy, and their reactions to changes in gas prices, have been produced by government agencies, academic researchers, and consumer and industry groups. These analyses often display conflicting results because of their choices of perspective and assumptions. In response to a request from the Subcommittee on Fossil and Synthetic Fuels of the House Committee on Energy and Commerce, the Congressional Budget Office (CBO) has prepared this background report, which provides a conceptual framework for understanding the energy market and economic effects of changes in natural gas pricing policy. This framework allows a comparison of the various analyses of price changes. In keeping with CBO's mandate to provide objective analysis, the report makes no recommendations. A companion paper, Natural Gas Pricing Policies: Implications for the Federal Budget, requested by the Senate Budget Committee, was released in January 1983.

The paper was written by several members of CBO's Natural Resources and Commerce Division. Timothy J. Considine prepared the chapters describing the gas market (Chapter II) and macroeconomic effects of decontrol (Chapter IV). Chapter III, dealing with microeconomics, was written by Michael D. Deich and Everett M. Ehrlich. Chapter V, which analyzes the redistributive effects, was prepared by Philip C. Webre. The report was prepared under the supervision of David L. Bodde and Everett M. Ehrlich. The authors are indebted to Dr. Knut Mork and Dr. Glenn Loury for their comments and criticism, although they are in no way responsible for the report's conclusions. Patricia H. Johnston edited the manuscript. Deborah L. Dove typed the many drafts and Philip Willis prepared the report for publication.

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SUMMARY

In 1978, the Congress passed the Natural Gas Policy Act (NGPA), which allowed gradual increases in the price of natural gas at the wellhead. The legislation sought to raise the price of most gas to the equivalent of the act's projected price of oil by 1985, at which time much of the nation's gas would be decontrolled. But the price of oil has risen well beyond the projections embodied in the NGPA, and the legislation contained no provision for correcting its gas price trends. Furthermore, contract provisions peculiar to the gas industry have led to further inflexibility in the gas market. Thus, the smooth transition once envisioned by the framers of the act may not occur. This circumstance is at the heart of several problems created by the NGPA, and has led many to reconsider the issue of natural gas pricing, particularly revised pricing schedules and contract provisions or outright decontrol.

Any policy involving gas pricing may redistribute, whether intentionally or not, tens of billions of dollars. The potential significance of any such policy change has led to a range of analyses that often reach conflicting conclusions and recommendations. Much of the difference among these studies lies in the choice of a perspective for analyzing the effects of gas pricing policy, the choice of assumptions concerning the features of the gas market, or the assumed response of the economy to higher gas prices.

In order to assist the Congress in comparing these analytic viewpoints, this paper attempts to organize these various perspectives, assumptions, and features into a single unified framework against which competing analyses can be measured. Its aim is to raise the questions that any analysis of gas decontrol must address in order to be credible. This framework considers the effects of natural gas wellhead pricing policy changes as they occur in three different but simultaneous contexts:

- o The economic adjustments in the natural gas markets;
- o The effects on the entire economy as households and firms adjust to higher natural gas prices; and
- o The effects on the distribution of income among individuals, regions and economic sectors.

Although these three contexts can be separated, the changes they describe all occur simultaneously. Thus, the framework presented here seeks to unify these three interrelated types of effects. How these effects will be resolved will depend on the answers to several questions:

- o What is the price of oil during gas decontrol?
- o What is the content of natural gas contracts between producers and pipelines?
- o How do households, nonenergy firms, and gas producers react to new gas prices?

THE NATURAL GAS MARKET

The natural gas market is an integrated system that contains a sequence of steps, including production of the gas resource for sale to long-distance transmission (pipeline) companies; sales from transmission companies to local distribution companies; and sales from local distributors to end users. Decisions at each of these steps are affected directly and indirectly by federal and state natural gas regulatory policies. The deregulation envisioned under the NGPA, and under all similar recent proposals, applies only at the wellhead. All downstream activities appear likely to remain subject to regulatory control.

Wellhead gas prices have been controlled at the federal level since 1954 but originally were applied only to interstate gas (gas produced in one state and sold in another) and not to intrastate gas (gas produced and sold within one state). The problems raised by this partial regulation scheme led the Congress to pass the NGPA in 1978. The NGPA set different prices for various categories of interstate and intrastate gas. In addition, prices of some categories were completely deregulated, while others were permitted to increase at the rate of inflation plus a real growth premium.

Gas at the wellhead is sold to interstate transmission companies that purchase, sell, and transport gas across state lines. Their allowed profits are regulated by the Federal Energy Regulatory Commission (FERC) and are based on the value of their capital assets and not on operations. The price pipeline companies can charge is set by the purchase price they pay for gas plus their allowed rates of return. Their profits are spread over a base volume of gas, determined annually by FERC. If this base volume is sold, the total allowed rate of return is realized. This regulatory policy tends to limit the incentive for transmission companies to engage in competitive bidding for gas supplies. Pipeline companies do not have an unchecked

ability to pass on costs--higher rates associated with increased costs could lead to reductions in natural gas demand below the base volume determined by FERC. But this load loss would lead FERC to revise downward the volume of gas over which the pipeline can earn its allowed rate of return. Thus, this incentive to minimize costs is considerably weaker than the incentives faced by firms in conventional competitive industries.

Gas transmission companies sell to local distribution companies. These distribution companies purchase gas at a single price that is an average of old, low-cost gas and high-cost gas from new sources. To the extent that large volumes of low-cost gas are available, distributors and ultimately users are shielded from the higher incremental costs of new gas. Hence, pipeline companies can sell gas whose wellhead price is above the price for which it will ultimately be sold.

State public utility commissions (PUCs) determine the rates that different classes of final customers pay for natural gas. Historically, these schedules have been characterized by declining prices for incremental amounts of gas reflecting economies of scale in the gas industry. But increasing costs for new gas in recent years have made such pricing policies inefficient. In addition, PUCs establish priorities for curtailments in the event of supply shortfalls. The curtailment policy serves to allocate natural gas when controls hold prices below their market levels.

EFFECTS OF DECONTROL ON THE NATURAL GAS MARKET

Control of prices restricts the ability of the competitive marketplace to realize the economic benefits--or "efficiency gains"--that result from improving the allocation of resources. Any analysis of the benefits of decontrolling the wellhead price of natural gas, therefore, centers around the notion of efficiency gains. Simply put, the decontrol of natural gas at the wellhead could lead to production of gas whose value to the user is greater than its cost to produce. This difference between use-value and cost is an efficiency gain.

Efficiency gains could be realized as new production occurred in response to the higher decontrolled price, allowing new gas users to buy gas and to substitute this newly available decontrolled gas for the more expensive alternatives currently in use. In general, the decontrol of gas would allow a more efficient production, distribution, and utilization of gas, and therefore, a potential increase in economic activity.

This increase in economic activity would be obtained, however, at the cost of a redistribution of income. The income transfer would occur as

consumers paid, and producers received, the decontrolled price for gas production that would have taken place even at the controlled price. Thus, for those already consuming gas, consumption of other goods, or savings would be decreased. Higher gas prices, therefore, would reduce the real income of these consumers, and, in turn, the incomes of those who produce the other goods they consume.

Analytic Subjects

The economic adjustments to higher natural gas prices in a competitive market raise two major analytic subjects. First, any analysis must depict the response of gas producers and consumers to price changes. These reactions will determine the efficiency gains associated with gas decontrol. Since uncertainty exists about the probable response of gas users and gas producers to higher prices, supply and demand relationships must be measured and their derivation is central to the outcome of any analysis.

Second, the effects of wellhead price decontrol are not instantaneous. The major consideration is the speed and sequence with which these effects will take place. The balance between supply and demand in a decontrolled market will ultimately occur, but prices may fluctuate during the transition. This adds to the uncertainty surrounding the timing and magnitude of demand and supply responses, and the realization of efficiency gains. Thus, any analysis of decontrol effects must address the way in which the gas market will reach its new equilibrium.

Special Gas Market Features

There are several unique features of the natural gas market that are important to consider in measuring the economic effects of natural gas decontrol and in evaluating various policy proposals that are intended to ensure a smooth transition to decontrol. These features will influence gas prices and, therefore, the size and timing of any efficiency gains and income transfers resulting from natural gas decontrol.

The Nature of Gas Contracts

Many gas contracts between producers and pipeline companies have provisions that tie the price of gas either to the highest price paid elsewhere for gas or to the price of distillate oil or other petroleum products. Thus, upon decontrol, some gas may rise to the price of distillate oil or higher and, because of contract provisions, this price could spread to other contracts.

Substantial amounts of gas may rise, therefore, to prices that cannot be sustained by the pipelines, although they would be forced to pay for unmarketable gas because of the existence of "take-or-pay" provisions. The long-term nature of many contracts compounds the problem. Any analysis of decontrol must address the content of gas contracts in order to assess the likelihood that gas prices will be locked into unsustainable levels.

Average Cost Pricing Policies. Pipelines sell their gas for a price that is the average of all the prices the pipelines pay for gas (plus their allowed rate of return). Since some pipelines have substantial supplies of low-cost gas under old contracts, they may be able to pay more than the long-run equilibrium price for additional supplies. This is commonly known as "the fly-up problem," and whether or not it will occur extensively with decontrol is uncertain. The fly-up problem may also create regional economic imbalances. If the endowment of low-cost gas is, in fact, unevenly distributed among regions, as it most likely is, then regions with this endowment may have a greater ability to compete for new gas supplies than would their counterparts. Thus, the distribution of old, low-cost gas is an important analytic consideration. Also in question is whether a skewed distribution of low-cost gas supplies would lead some pipelines to fail.

Vertical Integration. Some pipelines own their own gas reserves, creating the potential for circumventing regulatory controls by charging a "transfer price" that allows monopolistic profits to be transferred from the regulated sector to the nonregulated sector. In these instances, pipelines potentially can behave like unrestrained monopolists by reducing output to the levels at which they can earn the greatest profits. This problem is exacerbated if such pipelines also have endowments of low-cost gas. Decontrol analyses should address the patterns of pipeline ownership of gas production.

Gas Supply Allocation Policies. Existing gas supplies have traditionally been allocated not by price but by regulation or historic pattern. Access to gas has been restricted (by disrupting supplies to commercial and industrial users and forbidding new hook ups) in order to suppress the excess demand for gas induced by below-market prices. Decontrol would eliminate the need for this type of rationing. Thus, any analysis of gas decontrol must estimate the extent to which the demand for gas has been artificially restrained.

EFFECTS OF DECONTROL ON THE ECONOMY

Natural gas decontrol could create price and income effects capable of substantially influencing macroeconomic activity. An important factor is

the adjustment of the nation's economy to the income effects--the transfer of income from gas consumers to gas producers and consumers' ensuing loss of purchasing power for other goods and services. These income changes could affect the composition of consumption and the level of employment and output. In addition, increased natural gas prices under decontrol will change relative prices throughout the economy, which could have inflationary consequences.

The macroeconomic impact of natural gas decontrol is the result of several competing factors. The level and rate of increase in natural gas prices will largely determine the inflationary effects of decontrol and the changes in relative prices that influence consumption and production decisions. In the short run, higher natural gas prices will reduce consumer discretionary income and, therefore, reduce the level of expenditures consumers can maintain for nonenergy goods. These reductions in consumption expenditures will limit the ability of nonenergy producers to employ workers, purchase energy and materials, and pay returns on capital investments.

While this income effect will lower expansion of overall output and employment, households and industry will adjust over time to the changed relative prices of natural gas and other goods and services. These adjustments will provide long-term economic benefits. Furthermore, gas producers will recirculate income by respending increased revenues on new investment projects and additional workers. These changes will allow the economy to produce more output with fewer inputs and, therefore, raise national income by realizing potential efficiency gains. Thus, price and income effects work against one another. The adjustment of the economy to natural gas price decontrol will be determined, therefore, by the relative sizes and speeds of these two effects.

THE DISTRIBUTIONAL EFFECTS OF DECONTROL

There are four dimensions to the distributional consequences associated with natural gas price decontrol. The first involves the functional distribution of income, defined as the shares of wages, profits and interest of national income received by various economic sectors and individuals. The second feature reflects shifts in the industrial composition of aggregate economic activity. Both of these factors will result from the macroeconomic adjustments to decontrol described above. The third dimension concerns shifts in the regional composition of employment, income, and output. These compositional shifts can be inferred from the sectoral shifts that will closely parallel the geographic distribution of economic activities. The last distributional dimension is the distribution of

income across income classes. If the demand for natural gas is more price inelastic among low-income individuals than among higher-income persons, then decontrol will skew this income distribution. Analysis must address these issues in order to capture the distributional effects of gas pricing changes. These effects themselves are rooted in the micro- and macro-economics of gas pricing policy.

In 1978, the Congress passed the Natural Gas Policy Act (NGPA), which established gradual increases in the wellhead price ceilings for natural gas. The legislation tied these ceilings to a projected "heat equivalent" price of oil in 1985, at which time much of the nation's gas would be decontrolled. Oil prices have risen dramatically since 1978, however, so that they now far exceed the projections for 1985 used in NGPA. ^{1/} Thus, the smooth transition to decontrolled prices envisioned by the framers of the act will not occur. This circumstance, combined with other potential problems raised by the NGPA, has led many to reconsider gas pricing policy, particularly whether or not a revised pricing schedule, or outright decontrol, is in order. Among the possible policy changes that could be made, this report focuses on the effects of decontrolling wellhead gas prices. The report also discusses two special characteristics of the natural gas market that will influence the economic effects of decontrol: the regulation of gas sales from pipelines to local distribution companies and from those companies to gas users, and some provisions of natural gas contracts between producers and pipelines.

The decision about the treatment of natural gas pricing should be based on an analytic foundation that correctly describes the economic advantages and disadvantages of alternative pricing policies. Significant changes in gas pricing policies would have a sizable impact on the economy. To put the matter in perspective, complete decontrol could increase the wellhead price of natural gas by \$1.00 per million cubic feet (a plausible, and to some analysts, likely outcome). This would result in a redirection of income flows that would be half as large as the projected \$37.7 billion tax reduction in fiscal year 1982 under the Economic Recovery Tax Act of 1981. ^{2/} Furthermore, gas price increases would alter relative prices throughout the economy and lead to additional effects on real spending and

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1. The NGPA uses an oil price of \$15.00 per barrel (in 1978 dollars) as a target for prices of "new" gas in 1985. With current projections of inflation, this real price translates into roughly \$24 dollars per barr .. in nominal 1985 dollars.
 2. Congressional Joint Committee on Taxation, General Explanation of the Economic Recovery Tax Act of 1981, December 31, 1981, p. 380.

production activities. Thus, gas decontrol could have economic effects as significant as those of a major fiscal policy initiative.

The potential economic effects of changing natural gas pricing policy have prompted a range of analyses that often contain conflicting conclusions and recommendations. Much of the variation among these studies lies in the choice of a perspective from which to examine the economic adjustment to higher gas prices. On which effects should the analysis focus? How should macroeconomic adjustments be considered? What assumptions should be made about supply and demand responses, income flows, and employment effects? Additional differences arise from features not commonly found in other markets, such as long-term supply contracts, average cost pricing, and state and local regulation of gas sales. These features call for modifications of the standard economic analyses that are applied to the general problem of market adjustment and price decontrol. This background paper attempts to organize these different perspectives, assumptions, and unique features into a unified framework against which the various analyses of natural gas price decontrol can be compared.

Chapter II describes the evolution of the U.S. natural gas market and its principal stages: exploration, production, transmission, and distribution. Each of these stages involves different economic actors and has varying levels of government regulation or intervention. Chapters III, IV, and V describe the three major perspectives that can be used to describe the economic adjustment to natural gas price decontrol and demonstrate their interrelatedness. Chapter III approaches the problem from the perspective of the natural gas market, including supply and demand responses and the specific features surrounding gas provision. Chapter IV describes the possible macroeconomic responses to higher gas prices, focusing on the income flows and relative price changes that accompany the demand and supply responses described in Chapter III. The macroeconomic chapter discusses the effects on the gross national product, inflation, and employment associated with changes in gas prices, and also suggests how these effects are distributed within the economy to various regions, income, classes, and industries. These distributional influences are presented in Chapter V.

The marketing of natural gas involves a sequence of steps, including:

- o Production of natural gas for sale to long distance transmission companies;
- o Sales from transmission companies to local distribution companies; and
- o Sales from local distribution companies to end users.

The history of the natural gas market is a history of controls that led to changed behavior by gas producers and consumers, unintended economic effects, and unanticipated judicial interpretations and administrative burdens, all of which were subsequently followed by new or different controls. As a result, the gas market is now as much the product of political and regulatory decisions as of economic signals on supply, demand, and prices.

THE EVOLUTION OF NATURAL GAS POLICY

Natural gas regulation was established with the enactment of the Natural Gas Act of 1938 (NGA). Judicial interpretation of the NGA determined the format of subsequent federal gas regulation and the kinds of problems that would eventually arise under it. Knowledge of the history of federal regulation under NGA is, therefore, a necessary first step in understanding the issues surrounding current natural gas policy.

The Natural Gas Act of 1938 and Federal Regulations

The justification for federal intervention in the natural gas market was based on a series of Federal Trade Commission (FTC) reports that documented numerous abuses, including monopolistic control over prices by pipeline companies. As a result, the FTC recommended federal regulation of interstate (but not intrastate) natural gas prices. ^{1/} Legislators introduced

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1. Interstate gas is produced in one state and sold in another. Intrastate gas is produced and sold within one state.

natural gas bills in the Congress annually from 1935 to 1937, generally as proposals to regulate interstate pipelines in the same fashion as electric utilities. A bill was finally approved by the Congress and signed into law by President Roosevelt as the Natural Gas Act of 1938.

The NGA was designed to control pipeline monopoly in order to protect consumer interests. The act introduced the use of price ceilings for the resale of interstate gas. These prices were calculated according to the traditional public utility method, in which prices were set to cover actual costs plus a reasonable rate of return and depreciation.

The Federal Power Commission (FPC) administered the NGA and first focused its attention on the regulation of pipelines. The scope of NGA was expanded in 1954, however, with the U.S. Supreme Court's decision in *Phillips v. Wisconsin*. According to the Court's interpretation, the NGA required the FPC to regulate rates charged by natural gas producers, as well as pipelines, for interstate gas. In short, the FPC was given the authority to regulate the wellhead price of interstate natural gas.

The FPC initially set wellhead prices for producers on an individual basis. This laborious procedure required the commission to determine the capital charges and operating costs to be allowed for each producer in order to calculate individual cost-based prices, leading to a huge backlog of cases. As a result, the FPC established producer prices for entire geographic regions, based on regional average production costs and allowed rates of return. The U.S. Supreme Court upheld the concept of area-wide pricing in the *Permian Basin Area Rate Case* of 1968.

Since the interstate price of gas was set below its market rate, the demand for gas began to exceed supply. In order to increase price incentives for gas production, in 1974 the FPC established a higher price for gas from wells drilled on or after January 1, 1973, thereby introducing the concept of "new" and "old" gas. The FPC also included an annual price escalator and excluded certain state and federal taxes and allowances from the calculation of wellhead prices.

The FPC also recognized that the interstate-intrastate market distinction had become a problem. The regulated interstate market price did not provide adequate incentive to draw supplies from the unregulated intrastate market in which prices were higher. Furthermore, interstate demand remained artificially high because the new, higher gas prices were averaged with the old, low gas prices. Thus, the average price paid by consumers of interstate gas did not reflect its full economic value.

This mode of regulation, together with an absence of regulation in the intrastate market, had produced perverse results by the early 1970s. Gas shortages were beginning to appear in interstate markets. Industrial gas users, who had paid lower rates for interruptible supplies, found themselves facing curtailments. These curtailments resulted in layoffs of workers and consequent pressure on the Congress for action. In contrast, since intrastate gas brought higher prices than regulation allowed in interstate markets, gas supplies were ample in the intrastate market. In response to severe shortages in the interstate market during the winter of 1976-1977, aggravated by the effects of the OPEC embargo of 1973-74, the Congress adopted emergency measures to allocate existing supplies and began the difficult process of revising natural gas pricing policy. The result was the Natural Gas Policy Act of 1978.

The Natural Gas Policy Act of 1978

The Natural Gas Policy Act (NGPA) of 1978 combined price controls and deregulation by creating nationwide price ceilings and by allowing phased deregulation of certain categories of gas. It sought thereby to reduce regulation significantly without major dislocations. An overview of NGPA is presented in Table 1. As the table illustrates, the sections of NGPA can be classified into three major categories: those that provide supply incentives; those that provide consumer protection; and those that promote uniformity in gas markets by regulating intrastate prices.

Supply Incentives. The incentive provisions were designed to increase the nation's natural gas supply. In general, newly discovered gas, as defined in NGPA, is allowed gradually increasing prices projected to reach an assumed equivalent of the price of oil by 1985.^{2/} Thereafter, the wellhead price will be decontrolled. Several categories of new gas were defined, each of which was given distinct price and decontrol treatment. The Section 102 category covers gas found outside 2.5 miles of an existing well, gas found 1,000 feet below the completion depth of an existing well, gas from outer continental shelf leases, and production from new reservoirs. The price ceilings allow the gas defined by Section 102 to increase at the annual rate of inflation plus a real growth premium. New onshore gas produced within existing fields is included in Section 103, with its price increasing only at the annual inflation rate. Both Section 102 and Section 103 gas will be deregulated on January 1, 1985. "High-cost" gas is defined in Section 107 to

2. Note that the oil price projected for 1985 in the NGPA is much lower than current oil prices.

TABLE 1. OVERVIEW OF THE NATURAL GAS POLICY ACT OF 1978

Sections	Description	Price Escalation Formula	Status as of 1/1/85
Supply Incentives			
102	New natural gas outside existing fields; new reservoirs; new outer continental shelf fields	Annual inflation plus real growth premium	Deregulated
103	New onshore wells within existing fields	Annual inflation	Deregulated
107	High-cost gas	Deregulated immediately	Deregulated
108	Stripper wells	Same as 102	Regulated
Consumer Protection			
104	Old interstate gas	Same as 103	Regulated
106a	Renegotiated interstate contracts	Same as 103	Regulated
109	All other gas	Same as 103	Regulated
Intrastate Market			
105	Intrastate gas	Tied to new gas prices	Deregulated
106b	Renegotiated intrastate contracts	Same as 103	Deregulated if contract price is greater than \$1.00 per thousand cubic feet

include gas from wells drilled below 15,000 feet and that produced from geopressurized brine, coal seams, Devonian shales, and other high-cost sources. This gas was decontrolled immediately.

Consumer Protection. Consumers were to be protected by continued price controls on the gas already in production, termed "old gas." Section 104 sets the ceiling price for natural gas already dedicated to interstate commerce. The maximum lawful price in contracts that are renegotiated is determined by the provisions set forth in Section 106 of NGPA. The Section 106a price is the higher of either the contract price in the expiring contract or \$0.54 per million British thermal units (Btus), both escalating at the annual inflation rate. Section 109 is a catch-all category. Each of these categories remains regulated until their gas is exhausted.

Intrastate Gas Regulation. The last major part of NGPA imposed price controls on intrastate gas to limit the ability of intrastate users to bid supplies away from interstate users. For Section 105 gas, the price ceilings are tied to new gas prices (Section 102). Section 106b includes provisions for setting renegotiated intrastate prices that closely follow the methods employed in Section 106a. The intrastate gas categories will, for the most part, be deregulated in 1985.

NATURAL GAS PRODUCTION

Production decisions by gas producers are strongly influenced by regulatory policies. Both the exploration for and production of natural gas fields are influenced by the prices that regulation allows. For example, the NGPA, by giving preferential price treatment to new natural gas fields and high-cost gas, encouraged these activities over the development of existing, lower-cost gas reserves. Thus, the NGPA may have been partly responsible for producers selling higher-cost gas before lower-cost gas, the opposite of behavior patterns found in unregulated markets. Moreover, uncertainty over the future course of wellhead price regulation may inhibit the production and marketing of gas. As will be seen in subsequent sections, many contracts between gas producers and transmission pipelines contain terms that either reflect this uncertainty or distribute between those two parties the risks that regulatory rules will be changed.

SALES TO TRANSMISSION COMPANIES

Interstate transmission (pipeline) companies purchase, sell, and transport gas across state lines. These companies are essentially natural monopolies because of the economies of scale in gas transmission. Consequently,

they are treated as public utilities by the Federal Energy Regulatory Commission (FERC), created by the Congress as the successor to the FPC. Sales and transactions are strictly controlled and profits are limited to a specific rate of return based on the value of the pipeline's capital stock. The gas is sold at cost plus the regulated rate of return.

The method of regulating the interstate gas transmission market affects pipeline decisions. Since a pipeline's profits are based on the value of the capital stock and not on operations, lower gas prices do not readily result in higher pipeline profits. In addition, the limited number of competitors within the pipeline companies' territories allows them to pass along costs to distributors, subject mainly to the competition of alternative fuels. These factors limit the incentive for transmission companies to engage in competitive bidding for gas supplies from producers. The pipeline companies, however, do not have an unchecked ability to pass on costs. The higher rates associated with these increased costs could lead to reductions in natural gas demand. This reduction would lead FERC to revise downward the volume of gas on which the pipeline can earn its allowed rate of return. This, in turn, could raise the unit price even further, possibly causing further decreases in demand. Pipeline companies are concerned about the potential downward spiral.

Despite the regulated nature of gas markets, the final terms of the sales agreements between natural gas producers and pipelines are also influenced by the relative bargaining position of the two parties. Some gas producers may have fields close to several pipelines so that they can obtain an array of competitive bids. Or, if the producer has one field with access to only one or two pipelines, he may bargain with these pipelines to link the sale from his first field to a higher price for gas from a second field. Pipeline companies may also offer to pay royalties and severance taxes for producers in order to obtain better contract conditions. Furthermore, there are nonpecuniary factors that enter the negotiating process, such as personal relationships, client dependability, and other reciprocal factors. Thus, producer-pipeline sales agreements, although determined in an environment of regulated prices, are subject to some of the forces that affect business dealings everywhere.

The sales contracts between producers and pipelines generally include three major components: term, volume, and price. The term of a contract stipulates the length of time for which the contract is valid and the conditions necessary for its renewal. Most long-term contracts--greater than 20 years--were negotiated before 1970. Recent contracts are for shorter time periods, reflecting producers' fears of being locked into fixed prices in a period of inflation.

The volume establishes the obligations and rights of the two parties with respect to the amount of gas delivered and purchased. Often volume rather than price is the key contract provision for pipelines, because of pressure to fulfill customer orders and to maintain pipeline utilization as close to capacity as possible. This often leads to long-term contracts with prices pegged to the ceiling prices for various categories of gas under NGPA. Many recent contracts for deregulated gas peg the maximum price to the price of number 2 fuel oil. Other contracts allow prices to be renegotiated periodically. This renegotiated price may be set by oil prices or, often, the weighted average of the three highest gas prices within a certain distance from the gas field. Older long-term contracts have fixed prices and generally do not include conditions for renegotiation. As will be seen, long-term contracts with guaranteed prices may introduce distortions in the gas market.

SALES TO DISTRIBUTORS

Natural gas sales between transmission companies and distributors usually take place across state lines and, hence, are regulated by FERC. In addition, state public utility commissions (PUCs) can influence these transactions since they regulate the costs distributors can pass on to end users. These sales can be considered as wholesale transactions, and the subsequent sales by distributors to the final users as retail.

The wholesale transactions are governed by service agreements that are approved by FERC and state PUCs. These agreements, like the pipeline contracts with producers, also include provisions that specify the term, volume, and price. The price in a service agreement is determined by FERC, based on rate schedules that establish different prices for various conditions of the sale. These rate schedules have two major cost components: the purchase price of the gas paid by the transmission company to the producer, including any severance taxes, and transportation costs. The latter include a return on the pipeline's investment, depreciation, interest, operations and maintenance, and property and income taxes.

Distribution companies purchase gas from pipelines at a single price that is an average of old, low-cost gas, higher-cost new gas, and high-cost supplemental gas, such as imported liquefied natural gas. To the extent that large volumes of low-cost gas are available, distributors and, ultimately, users are shielded from the higher incremental costs of the other gas. The average cost pricing practiced in the industry reduces the marketing risk associated with the purchase of high-cost gas. Thus, if a hypothetical pipeline has contracts for half its gas at a price of \$2.00, and faces a market price for gas of \$4.00, it can buy new gas at a price up to \$6.00 and still sell

it without incurring a loss. Therefore, the pipelines can sell gas whose cost is above its market value.

Integrated companies that produce and transport natural gas may use an artificially high "transfer price" to shift profits to the production subsidiary. This is advantageous because FERC regulates the rate of return, and, therefore, the profits, of transmission companies. Since some integrated companies have a relatively large cushion of low-cost gas, the production subsidiary could sell its gas to the pipeline subsidiary at inflated, illegal prices, thus transferring profits back to the production end. In fact, in some antitrust cases FERC and the U.S. Justice Department have requested that producers provide information on their bids. This monitoring has motivated many producers to send out formal bid requests, in order to document their antitrust compliance.

SALES TO END USERS

The Natural Gas Policy Act of 1978 mandated an "incremental pricing" system. This law requires FERC and state PUCs to establish two categories of gas prices to be paid by different types of final users. The first category applies to industrial boiler users and to other industrial customers determined by FERC. The second price applies to all other users of natural gas, including residential customers. The burden of new higher prices allowed under NGPA is initially placed on customers in the first category. Once all the gas purchased by these users has reached the price ceiling specified by FERC, the price is frozen and any additional sales of higher price gas are borne by customers in the second category. (The price in the first category is set at the Btu equivalent price of an alternative industrial fuel.) The net result of this pricing policy is that gas prices for industrial users have recently been increasing faster than comparable gas prices for electric utility, residential, and commercial users.

The principles for allocating costs over time and among customers are set forth in the prices from the rate schedules determined by FERC. These principles are applied to cost allocation at both the wholesale and retail levels. These costs are based on distance of transport and/or whether customers are firm or interruptible. The former category includes residential customers. The latter category includes industrial and commercial customers who have the necessary equipment to switch fuels at low cost. These customers are willing to accept a contract that could interrupt their gas supply during peak seasons in return for lower rates during the rest of the year. In this case, industrial customers pay only a commodity charge, or a rate based on the amount actually purchased. Firm customers, or those

not willing to accept an interruptible service, pay this charge plus an additional fixed monthly charge.

State PUCs determine sectoral rate schedules. Historically, these rates decline as consumption increases, reflecting economies of scale in the gas industry. Increasing costs for new gas supplies in recent years, however, have made such pricing policies inefficient. Therefore, there has been a push by some state PUCs to "flatten" prices and to invert eventually the rate schedules so that natural gas users will make efficient resource allocation decisions and have stronger incentives to reduce gas consumption.

Retail natural gas sales are essentially regulated by state PUCs. FERC, however, has limited power under the Public Utilities Regulatory Policy Act (PURPA) to set ratemaking standards. The state PUCs have jurisdiction over the pass-through of distributor costs to retail customers.

Table 2 presents the consumption of natural gas by end users from 1970 to 1980. Industrial and electric utility use of natural gas constituted

TABLE 2. CONSUMPTION OF NATURAL GAS BY END USERS, CALENDAR YEARS 1970-1981 (In trillions of cubic feet)

Year	Residential	Commercial	Industrial	Electric Utilities	Transportation	Total
1970	4.84	2.40	9.25	3.93	0.72	21.14
1971	4.97	2.51	9.59	3.98	0.74	21.79
1972	5.13	2.61	9.62	3.98	0.77	22.10
1973	4.88	2.60	10.18	3.66	0.73	22.05
1974	4.79	2.56	9.77	3.44	0.67	21.22
1975	4.92	2.51	8.36	3.16	0.58	19.54
1976	5.05	2.67	8.60	3.08	0.55	19.95
1977	4.82	2.50	8.47	3.19	0.53	19.52
1978	4.90	2.60	8.40	3.19	0.53	19.63
1979	4.97	2.79	8.40	3.49	0.60	20.24
1980	4.80	2.70	8.24	3.68	0.59	20.02
1981	4.73	2.66	7.93	3.76	0.63	19.71

SOURCE: U.S. Department of Energy, Energy Information Administration, 1980 Annual Report to Congress, vol. II, DOE/EIA-0173(80)/2 (1980). Data for 1981: U.S. Department of Energy, Monthly Energy Review.

roughly 60 percent of total gas consumption in 1980. ^{3/} While the industrial share of total natural gas consumption has declined by over 10 percent since 1974, total natural gas consumption has remained virtually constant.

3. Gas utility industry revenues were \$38.9 billion in 1979. American Gas Association, Gas Facts, Department of Statistics (1979).

CHAPTER III. EFFECTS OF DECONTROL ON THE NATURAL GAS MARKET

The economic effects of natural gas wellhead price decontrol can be viewed from three perspectives:

- o The economic adjustments in the natural gas market;
- o The effects on the economy as a whole; and
- o The effects on the distribution of income among individuals, regions, and economic sectors.

This chapter develops the first view--adjustments in the natural gas market. Before policymakers can determine the effects of wellhead price policy changes on gas markets, they will need to know the answers to the following questions:

- o What is assumed about the price of oil during decontrol?
- o What is assumed or known about the content of natural gas contracts, specifically, the extent of provisions that tie gas prices to oil prices, to other energy prices, or force pipelines to "take-or-pay" for high-cost gas?
- o How will supply and demand react to changes in gas prices?
- o What policy options exist for ensuring an orderly transition to decontrol?

The decontrol of natural gas prices at the wellhead ultimately would result in aggregate economic benefits through an improved allocation of resources. The higher gas prices that would allow such an adjustment would also redistribute significant amounts of income away from gas consumers (and from the producers of other goods) to gas producers. Special characteristics of the gas market, which are discussed in this chapter, influence the size of both of these effects. These special characteristics would also affect how the natural gas market adjusts after decontrol. A decontrol proposal, therefore, should address these features of the gas market.

WELLHEAD PRICE DECONTROL IN AN IDEAL COMPETITIVE MARKET

It is helpful to begin with a review of the effect of natural gas price decontrol in an ideal situation. Then the idealized picture can be modified to capture the special features of the natural gas market.

Efficiency Gains

Control of natural gas prices--or for that matter, of the price of any commodity--restricts the ability of the economy to improve the allocation of its resources. Removing this restriction would provide any anticipated benefits from decontrol. "Efficiency gains" are the economic benefits that result from improving the allocation of resources through expanded opportunities for exchange. Understanding an efficiency gain is, then, the first step toward understanding the benefits to be derived from the decontrol of natural gas wellhead prices.

Society may have many uses for any given resource. Natural gas, for example, can be burned by households and businesses or used as a feedstock for fertilizer. What is the best allocation of a fixed amount of gas (or any other commodity) among such competing uses? Like the household that allocates a fixed budget to buy the items it values most, society can derive the greatest benefit from its resources by using them in their most highly valued way.

For example, suppose that a steel mill pays \$4 for a thousand cubic feet of gas. At the same time, an adjacent petrochemical plant is willing to pay \$6 for the same amount of gas to replace the more expensive oil it uses as its feedstock. In this case, an improved allocation of gas between these two users is possible. The petrochemical plant could approach the steel mill and buy its gas for \$4. The steel mill could then use the \$4 to buy residual oil or coal for its furnace, and end up as well off as before. At the same time, the petrochemical plant has saved \$2 relative to the cost of the oil it previously used. This saving may accrue to the plant's stockholders or to its workers in the form of higher wages. Setting aside for a moment any value judgment about distribution, the exchange has clearly improved the aggregate well-being that this hypothetical two-firm economy derives from its resources. Changes in the distribution of this benefit do not reduce its size. The steel mill, aware of its bargaining position, could have charged the petrochemical plant up to \$6 for the gas; this would have changed the distribution of well-being, but not the aggregate economic improvement. Regardless of who derives the benefit, \$2 is gained in this two-firm economy. This \$2 is called an efficiency gain because it is realized by improving the overall efficiency of resource allocation through exchange of goods.

Efficiency gains are sometimes described as "consumers' surplus" or "producers' surplus"--terms that describe ways in which efficiency gains can be realized. To illustrate with another example, a hypothetical household must choose between oil and electricity as a heating fuel at a cost of \$1,000 for the winter. New gas capable of delivering the same volume of heat at \$800 becomes available. Even though the household is willing to pay \$1,000, it no longer has to. By switching to gas, the household can save \$200. This \$200 difference between what the household was willing to pay and what it actually paid is called "consumers' surplus" and is a type of efficiency gain. The gain is the difference between the market price of a good and the value of the next-best alternative to that good. By another definition, it is the amount a consumer saves by switching from a higher-valued alternative to a cheaper substitute. Consumers' surplus can also occur simply because some goods are cheaper than the price consumers are willing to pay for them. For example, although a household may be willing and able to pay \$6.00 for a thousand cubic feet of gas, gas may cost only \$4.00. Such a household in effect saves \$2.00 by being able to buy gas at the market price, rather than at its subjective value. It may use the difference to buy more gas, more other goods, or to save. But in any case, the savings become part of the household's well-being and of total economic activity.

Similarly, unregulated producers can realize a "producer's surplus," or, conventionally, profit. For example, if a firm can produce a thousand cubic feet of gas for \$3.00, but can sell the gas for \$5.00, the firm realizes a profit, or a producer's surplus, of \$2.00. But the \$2.00 is more than profit--it is the added value the economy obtains from transforming materials and labor into natural gas. The \$2.00 is added into the economy and generates additional income, investment, and savings. Again leaving aside distributional considerations, producers' surplus has thus raised the value of the goods society can produce from its resources, and, therefore, its well-being (in this instance, transforming \$3.00 worth of materials and labor into \$5.00 worth of gas). Thus, as long as resources can be transformed into higher-valued goods--through either exchange or production--economic benefits result.

What is the nature of these benefits? In the case of producer's surplus, efficiency gains are translated into increases in national income. This occurs as profits are realized on production, and then invested or distributed as dividends. In either case, the increase in profit becomes an increase in aggregate demand in the economy, experienced either as increased investment (if profits are reinvested, either directly or through savings) or increased consumption of other goods and services.

In the case of consumer's surplus, the effects are less clear. Consider the above example of the consumer who seeks to heat his home for the

winter. In this case, the saved \$200 becomes an increase in the consumer's disposable income, available for increased consumption or savings. This efficiency gain is directly translated into increased economic activity. Examples can be constructed, however, in which efficiency gains do not translate readily into increased economic activity. For example, suppose that the household discussed above would be willing to pay \$6.00 for a thousand cubic feet of gas that costs \$4.00 for a saving of \$2.00. Perhaps this household's use for gas, and, consequently, the value it assigns to it, increases to \$6.50. The market price of gas, however, remains the same. Thus, this household's consumer surplus will not be realized as income, even though the household is now "better off" by an additional \$0.50. In this case, although the efficiency gain increases, as does some notion of the household's welfare, these improvements will not be reflected in the national income accounts.

The gains through exchange that are experienced in the natural gas market are generally of the type that create new income--producers' surplus. Increased profits in the natural gas sector can be recognized as increased investment or spending by gas-producing firms and increased employment and economic activity in gas-producing regions. Those households that consume any new natural gas that decontrol might induce would realize efficiency gains as additional disposable income if their consumption of gas displaces the consumption of some other, more expensive, energy source.

The new income that efficiency gains deliver is not realized immediately, however. Like the efficiency gains themselves, the added income that decontrol could create would occur only as resources were reallocated--that is, as more inputs were allocated to natural gas production, as gas deliveries were reallocated to displace higher-priced fuels, and as the economy adapted to higher gas prices. A variety of circumstances would impede this process: the time required to secure new productive inputs, to relocate labor and other factors of production, to plan new gas exploration and production investments, and rigidities in wages and prices. In the absence of these frictional impediments, efficiency gains would be readily translated into increased national income. With these impediments, efficiency gains should be conceived of as an outer bound of increased national income, a "target" level of increased well-being that might or might not ultimately be achieved because of both timing considerations and the fact that some efficiency gains are not translated into income.

This increase in economic activity resulting from higher gas prices, however, would be obtained at the cost of a redistribution of income. The income transfers would occur as consumers pay, and producers receive, the

decontrolled price for gas production that would have taken place even at the controlled price. Thus, for those already consuming gas, consumption of other goods or savings would have to decrease. Higher gas prices, therefore, would reduce the real income of these consumers and, in turn, the incomes of those who produce other goods.

Empirical Questions

The description of the adjustments to higher natural gas prices raises two major empirical questions that are applicable to any market. The first concerns the nature of supply and demand in the gas market; these determine the size of the efficiency gains and income transfers associated with gas decontrol. The second question concerns the speed with which these effects occur. While the supply and demand relationships reveal what effects might inevitably occur in a decontrolled gas market, they do not indicate how quickly these effects would take place or in what sequence. This section discusses these topics.

Responsiveness of Supply and Demand. The efficiency gains resulting from wellhead price decontrol would depend directly upon the supply response of gas producers and the demand response of gas consumers. When supply and demand are more responsive to price changes (termed more "price elastic"), the efficiency gains are greater than when they are less responsive. For example, if wellhead price decontrol did not produce increased gas supplies, there would be no additional gas to exchange and, therefore, many of the efficiency gains discussed earlier could not occur. The result would be higher prices and smaller efficiency gains as gas users willing to pay the higher price bid the limited supplies away from those unwilling to pay it. On the other hand, if wellhead price deregulation brought forth ample supplies of gas, users could switch to natural gas from other, more expensive fuels. Unfortunately, the response of gas producers and gas users to wellhead price decontrol cannot be anticipated with great precision and must be assumed. Such assumptions are central to any analysis of changes in natural gas policy.

Lagged Response. The explanations of supply and demand relationships presented in the preceding section gives a static, or one-time, snapshot of market conditions. Even if the supply and demand relationships could be estimated with precision so that the ultimate efficiency gains and income transfers could also be determined, the speed with which these ultimate effects could be realized would still be unknown. While an efficiency gain can be described in theory, it cannot be achieved instantaneously. The efficiency gains resulting from gas decontrol would occur as consumers switched from more expensive alternatives to newly available gas and as

each producer combined resources to produce and explore for gas at a profit. Both of these activities take time. New hook-ups require planning by the local distribution company and state public utility commission (PUC), and may require new delivery systems. Investments in new production and exploration must precede the provision of new supplies. Firms require time to compare alternative investments, conduct basic geological work in preparation for drilling, and acquire inputs (for instance, rigs, drillbits, or engineers) that may be in short supply.

Moreover, after decontrol, the time path of rising prices is also uncertain. The equilibrium of supply and demand in a decontrolled market would ultimately be reached, but the path to this new price is ambiguous. Prices might fluctuate during the transition period, perhaps even rising above their new long-term level before reaching their ultimate value. This adds to the uncertainty surrounding the timing and magnitude of demand and supply responses and the realization of efficiency gains. Thus, any analysis of gas decontrol must address two major questions:

- o How will gas supply and demand respond to a given change in the price of natural gas and how can an estimate of this response be obtained?
- o What estimate of efficiency gains is obtained from these supply and demand responses?

WELLHEAD PRICE DECONTROL IN THE NATURAL GAS MARKET

The previous section discussed the effects of price decontrol in an idealized competitive natural gas market and described two major empirical problems associated with that market. Further refinement is required to analyze natural gas price decontrol, because the natural gas market does not have all of the requisite features of an ideal competitive market. This section shows how the theory of decontrol in a competitive market must be modified to incorporate the peculiarities of the natural gas market today. The existing market conditions that are examined include:

- o The Competitiveness of the Natural Gas Market. The competitive behavior of the natural gas market could influence the price paid for additional gas supplies and, therefore, the magnitude of the other effects of decontrol.
- o Gas Supply Allocation Policies. Existing gas supplies are now allocated principally by regulation or historic pattern rather than solely by price, as they would be in a free market. Thus, the

efficiency gains associated with decontrol would occur not only for new production but also for existing supplies as well.

- o Average Cost Pricing Policies (the Fly-Up Problem). Pipelines sell their gas for a price that is the average of all the prices pipelines pay for gas. Since some pipelines have substantial supplies of low-cost gas under old contracts, they may be able to pay more than the long-run market price for additional supplies. This is commonly known as "the fly-up problem." This problem may also create regional economic imbalances. If the reserves of low-cost gas are in fact unevenly distributed among regions, as they most likely are, then regions with these supplies will be more capable of competing for wellhead supplies than their counterparts. Thus, the distribution of old, low-cost gas is an important consideration, as is the content of existing gas contracts in general. Another consideration is whether a skewed distribution of low-cost reserves would lead some pipelines to fail upon decontrol.
- o Integration of Suppliers. There are over 12,000 producers of natural gas, enough, in theory, for a competitive market to exist. But some producers also own pipelines that enjoy the status of a regulated monopoly. In the absence of effective regulation, some producers might be able to exercise monopolistic power in some regional natural gas markets.
- o State PUC Allocation of Costs Among Customers. State public utility commissions determine the prices that different classes of final users pay for natural gas. Proper allocation of pipeline costs to various users might help ameliorate the adjustment costs that would follow decontrol, while improper regulation could increase them.

The Competitiveness of the Natural Gas Market

Whether or not economic actors are competitive depends largely upon how they make their decisions. A competitive supplier is one who must sell his product for the prevailing price (given his presumed inability to influence prices by manipulating his own level of output), and will continue to offer his product until the cost of producing it is not matched by the price received for it. Similarly, competitive demanders are those that seek to minimize the cost of purchases associated with any level of the satisfaction they derive from their purchases, or, alternatively, seek to maximize the well-being they derive from their expenditures.

The natural gas market is not universally competitive. The major distortions of competitive behavior appear in the regulatory status and behavior of pipeline companies. Pipelines earn their profits by selling enough gas to realize the rate of return allowed them by the Federal Energy Regulatory Commission (FERC). This rate is based on the value of the pipeline's capital assets, and is averaged over a volume of gas sales projected annually, as discussed in Chapter II. Once the pipeline sells this projected volume of gas, it has limited incentive to sell more. In fact, if it does sell more gas, FERC may increase the base volume of sales over which profits can be realized in the subsequent year, reducing the pipeline's future profits should sales fall short of the new, higher target.

On the other hand, if the pipeline fails to meet its projected level of sales, its loss of profits will be limited to that year, as FERC will allow the pipeline a lower level of projected sales to realize its allowed profits in subsequent years. The only constraint on this process is that the pipeline itself remain "used and useful," meaning that some amount of gas must move through it. Thus, pipeline companies have limited incentives to buy gas as cheaply as possible or to sell as much as possible. Rather, the regulation process predisposes these companies to secure large gas reserves, so that the pipelines will remain used and useful for as long a period of time as possible. Indeed, a pipeline company would be motivated to pay a premium for long-term supplies, even in a deregulated market, since the extraordinary capital costs of building a pipeline require some degree of confidence that gas supplies will be available over its productive life. This incentive now is magnified by the existence of a regulatory climate that rewards this behavior. To protect their supplies, pipelines may, therefore, buy gas at a higher price than they would in a strictly competitive market, and automatically pass these added costs along to their customers through "purchased gas" adjustments. Pipelines may also ensure their access to future supplies by agreeing to "take-or-pay" provisions in contracts with producers. These provisions require the buyer to pay for certain quantities of gas at preset prices regardless of whether delivery occurs at the time of payment. This type of noncompetitive behavior must be incorporated into any analysis of the natural gas market, since its existence affects the ultimate prices and quantities of gas in the wellhead market, and the subsequent allocation of that gas among regions and users. To understand the extent of this behavior, any analysis of the gas market must ask:

- o How much gas is contracted under take-or-pay provisions? If take-or-pay provisions are limited by a decontrol proposal, how much will gas prices be affected?
- o Is this estimate assumed or derived from surveys of the gas market?

- o Will purchased gas adjustments be allowed under a decontrol proposal? What discretionary authority will FERC have to allow pipelines to recover purchased gas costs?
- o How will FERC balance consumer protection with the need to pass through additional gas costs?
- o To what extent are pipeline purchases of high-cost gas motivated by the need to acquire additional gas reserves?

Another factor that limits competition in the gas market is that many gas users do not have equal access to gas sold by various producers.¹ A gas consumer, therefore, cannot easily bargain directly with a producer without first arranging a transportation agreement with a pipeline. This is partly attributable to the natural logistical advantage that pipelines have in arranging gas sales since most producing fields are connected only to one pipeline. In addition, pipelines generally own the gas they ship and, as a result, are not considered "common carriers" such as airlines or trucks. The ability of pipelines to influence the accessibility to gas raises the following questions:

- o If the regulatory status of pipelines is changed to common carrier status upon decontrol, will this affect the competitive bidding for gas supplies?
- o How will common carrier status for pipelines affect the obligations of pipelines and distributors to deliver gas to final users?

Gas Supply Allocation Policies

As a result of the controlled price of natural gas, demand sometimes has exceeded supply. In the discussion of decontrol in a competitive market, it was assumed that the limited supply was allocated as it would be in a free market--to those who were most willing to pay for it. In fact, the limited supply of natural gas has been distributed partially by historical accident and partially by regulation. To some extent, history has determined who receives existing gas supplies, for distribution companies must serve customers on a first-come, first-served basis. Once the distributor has agreed to provide service, regulations mandate that he must continue to do so as long as supplies permit. (There are some exceptions, but they are not significant.) The distributor cannot end service to one customer and begin service to another merely because the second customer is willing to pay more for the gas.

Gas demand has been constrained further both by law and by a series of rules issued by regulatory authorities. The Powerplant and Industrial Fuel Use Act of 1978, before its amendment in 1981, prevented electric utilities from building new gas-fired plants, forbade those not using gas at the time of the bill's passage to convert to natural gas and required those that did to find another fuel source by 1990. Regulatory actions also have prevented new natural gas hook-ups and have resulted in curtailments of natural gas deliveries to some commercial, industrial, and electric utility customers.

From an economic viewpoint, existing gas supplies have been misallocated for many years, in that those willing to pay the most for the gas do not necessarily receive it. This implies that wellhead decontrol of natural gas could result in efficiency gains greater than those described for an ideal competitive market. Specifically, as price, rather than regulation, is allowed to allocate gas supplies at the end-user level, economic gains would be realized through a more efficient distribution of existing supplies as well as through the production of additional natural gas. Understanding these conditions requires answers to the following questions:

- o How much will gas consumption increase if hook-up restrictions, the threat of curtailments, and fuel-use restrictions are eliminated?
- o How much will gas prices increase, if at all, from eliminating these nonmarket restrictions? How much will some potential gas users be willing to pay for newly available gas?

Average Cost Pricing Policies (the Fly-Up Problem)

As shown above, the efficiency gains realized by decontrol in a competitive market are determined by supply and demand relationships and the improved access to gas supplies if the decontrol proposal eliminates restrictions on gas use. The gains occur because natural gas price controls presumably preclude the production of some gas whose value exceeds its cost. The total social benefit of producing this gas is equal to the difference between the value its user assigns to it and the costs of producing it. A competitive decontrolled gas market would produce gas up to the quantity at which supply equals demand. At that quantity, any further production of gas would incur costs greater than the value attached to the gas itself.

Conversely, some circumstances can lead to the "overproduction" of gas--that is, some gas is produced at costs that exceed the value of that gas to its user. This situation can create efficiency losses in the manner that decontrol would produce efficiency gains. Average cost pricing policies by

regulated pipelines is one of these circumstances, and the resulting overproduction is commonly known as "the fly-up problem," since it leads to prices for new gas supplies that fly up over the presumed market price.

As stated before, regulated pipelines are usually required to sell gas at its average cost to the pipeline, plus some fixed rate of return on their net investment in the pipeline. This fixed return is averaged annually over a volume of gas sales estimated by FERC. Pipeline companies, therefore, can increase profits by increasing the quantity of gas sold, up to this estimated volume. This is true regardless of the relationship between gas prices and costs. In the absence of controls, if pipeline companies purchased all gas of equivalent characteristics for the same price, then the resulting gas market equilibrium would be identical to the one that would occur in an idealized competitive market. In the current gas market, however, similar gas is often purchased at very dissimilar prices.

Price differentials in the natural gas market arise partly from legal requirements, partly from custom. The NGPA defined eight major categories of natural gas, with gas assigned to a particular category on the basis of the reserve from which it is drawn. Each type of gas is subject to a different price ceiling, even though the gas has equivalent characteristics. In general, gas drawn from older reserves is eligible for a lower price than is gas drawn from reserves that are newer or more expensive to tap. For example, assume that a pipeline operates in a market in which the competitive price for gas at the wellhead is \$4.00 per thousand cubic feet. But because of its historic, long-term contracts, this pipeline can obtain a third of its gas for \$2.00 per thousand cubic feet. In this situation, a pipeline can spend up to \$5.00 per thousand cubic feet for the additional two-thirds of the gas it seeks to purchase, and still offer its consumers an average gas price of \$4.00. The price of the additional gas has flown up to \$5.00. Thus, under this type of average cost pricing policy, gas could be produced at costs (\$5.00) greater than the value that the market places on that gas (\$4.00). Under these conditions, average cost pricing on the resale of gas to distribution companies could lead to inefficient production and consumption decisions, and change the income transfers and efficiency gains associated with wellhead price decontrol. When the NGPA expires in 1985, a significant portion of natural gas is scheduled to remain subject to price controls. Several questions, therefore, arise at this juncture:

- o Will old, cheap gas be freed from price controls under the decontrol proposal?
- o If so, to what extent will the elimination of price controls on old gas provide sufficient incentive to renegotiate high-cost gas prices downward?

- o Will there be more pressure to renegotiate old gas prices to higher levels than new gas prices to lower ones?

But even if new legislation removed all price controls from natural gas, wide differentials might exist for some time. As discussed above, pipelines have sought to assure long-term supplies by purchasing gas under long-term contracts; often a price is specified for the duration of the contract. As a result, producers might not receive higher prices on some gas now under contract, even if the Congress were to remove price controls from all natural gas. The extent to which these contract prices could rise would depend upon escalation provisions in the contracts and whether the contracts are renegotiated. Although the exact number and content of these provisions is unknown, many existing contracts would allow some price increases in the event that gas controls were removed. The duration of gas contracts and their flexibility to respond to changing market conditions raise the following questions:

- o How much gas is sold under long-term contracts?
- o How are the pricing provisions in these contracts affected by decontrol?
- o How is contract renegotiation encouraged by the decontrol proposal? Does the decontrol proposal allow both parties to abrogate contracts by instituting a universal market-out provision?

Regional Imbalance. The efficiency losses associated with average cost pricing and its attendant fly-up problem could be compounded if different pipelines serving different regions have unequal amounts of old gas under contract. Suppose the pipeline in the example given above competes with another pipeline. This second pipeline has no old gas under contract, and faces the same market price of \$4.00 per thousand cubic feet. Since it has no older, cheaper gas with which to average the cost of new supplies, the second pipeline is constrained in the price it can offer for new gas. The unconstrained pipeline can spend \$5.00 per thousand cubic feet, while its unendowed competitor can offer only \$4.00. In this case, the pipeline with an endowment of older, cheaper gas (sometimes referred to as a "gas cushion") has a tremendous advantage when competing for new supplies.

If the disadvantaged pipeline decides to match this higher price, it will have to charge a higher price to its customers than it would in the absence of an average cost pricing policy. In so doing, it will reduce sales. Alternatively, the pipeline may restrict its sales to that level of gas that it can procure at the presumed market price of \$4.00. In either event, the pipeline without contracts that provide it with cheaper gas will probably sell

less gas than it could, or should, in a competitive market. Since average cost pricing results in an artificial restriction on the ability of unendowed pipelines to sell gas to its customers, the effects are similar to those of price controls, resulting in efficiency losses in the regions served by the disadvantaged pipelines. Analysis of individual pipeline purchases of gas is necessary to answer the following related questions:

- o What is the regional distribution of low-cost gas?
- o Does the regional distribution of low-cost gas endanger individual pipelines that lack such reserves?

Price Contagion. Most existing natural gas contracts were written in an environment of uncertainty about the future content of federal natural gas policy. Many contracts include features designed to accommodate future gas pricing rules. Among these are contracts that tie the price of gas to the highest price paid for gas in the relevant region (most-favored-nation" clauses) to crude oil, or to distillate fuel. These contract provisions are generally referred to as "indefinite price escalator" clauses. Thus, upon decontrol, many contracts would allow the price of their gas to rise to these levels. If this "price contagion" was widespread, either many of these contracts would have to be renegotiated, or the price of gas might be locked into a level higher than competitive markets would sustain. If prices were locked into above-market levels, then many of the benefits of decontrol might be minimized, the income transfers increased, and some gas pipelines might fail. Moreover, the effects of price contagion would be reinforced as the fly-up phenomenon forced gas prices far beyond the levels competitive markets would produce. In that case, the fly-up price offered by the pipeline with the greatest endowment of low-cost gas would set the standard for other gas contracts.

The price contagion problem raises the following questions that must be answered in any analysis of natural gas policies:

- o What pricing provisions exist in current gas contracts? To what extent do these contracts tie gas prices to the price of oil or other regional gas?
- o To what extent will the elimination of indefinite price escalator clauses alleviate price contagion?
- o What oil price is assumed for purposes of analysis?

Vertical Integration in the Natural Gas Market

Thus far, this chapter has assumed that producers sell in an "arm's length" competitive market to pipelines that act as regulated monopolies. In reality, some pipelines also own natural gas production facilities. The common ownership of regulated and nonregulated activities poses problems for the coherence of any regulatory scheme. When the regulated subsidiary of a firm acts as a customer of the nonregulated subsidiary, the potential exists for circumventing regulatory controls by charging a "transfer price" that allows monopolistic profits to be transferred from the regulated sector to the nonregulated sector. In a competitive world, the price of gas is determined by market interactions between gas producers and pipelines. Pipelines, seeking to expand sales so as to earn their allowed rate of return, may have some incentive to buy gas at the lowest available price in order to prevent loss of sales volume. But if a pipeline is linked to a gas producer through common ownership, this incentive is blunted. In these circumstances, the producer may charge the pipeline this higher transfer price. In effect, the pipeline serving a region can potentially behave like an unrestrained monopoly. While doing so would ultimately result in selling less gas, the higher price obtained for remaining gas sales may more than compensate for the reduction in sales. In economic theory, the rule generally used to characterize this type of monopoly is as follows: the monopoly will produce and sell so long as the revenues realized by sale of incremental production (that is, the gain in new sales minus the price discount allowed all previous sales) are greater than the cost of that incremental production. A monopoly conforming to this rule produces output so long as its sale adds to profits.

The application of this rule characteristically results in less output sold and a higher price for the output that is produced. If unrestrained, an integrated producer-pipeline may be able to restrict its output and increase its price in this fashion. By curtailing gas flows to its service region, the producer-pipeline prohibits gas consumption that would have occurred in a competitive market--that is, some amount of gas will not flow to this region, even though the value of this gas to its users is greater than the cost of producing it. Thus, some efficiency gains are precluded by monopolistic practices. To learn the extent of these efficiency losses, the following questions must be answered:

- o To what extent do gas pipelines own their own reserves? How was information about this pattern of ownership obtained?
- o Are the pipelines with owned reserves endowed with low-cost gas, allowing them to pay themselves a higher, fly-up price?

State PUC Pricing Policies

State public utility commissions set the prices that different classes of final users pay for natural gas. These pricing policies have evolved over time and probably reflect the outcome of competing political considerations rather than market forces. In addition, these pricing policies must conform to the incremental pricing system under the NGPA, whereby low priority users (generally large industrial users) of natural gas pay a larger share of gas costs. As a result, many state PUC pricing policies may encourage an inefficient use of gas.

Typically, natural gas prices, as administered by state PUCs, vary substantially among the principal customer classes: residential, industrial, and commercial. This practice is referred to as "price discrimination," and, combined with average cost pricing, tends to compound existing inefficiencies. The problem in price discrimination is that charging different classes of users a gas price that is either above or below the competitive price of gas tends to encourage either underconsumption or overconsumption of gas by the users. In terms of rates, therefore, the overconsumption by the consumer class paying artificially low prices is subsidized by the underconsumption of the users paying artificially high prices. The economic effects of these inefficient payments do not cancel each other, however. In the group paying artificially high prices, too little gas is consumed, suggesting that uses for gas remain that have values in excess of the cost of producing that gas, analogous to the problem of monopoly. In the consumer class paying artificially low prices, gas will be burned for uses with values less than its production cost, analogous to the fly-up problem. Thus, while underconsumption and overconsumption may cancel themselves in the aggregate--that is, the total amount of gas sold may resemble the amount that would be sold in a competitive market--the efficiency losses associated with each group's consumption do not offset each other. Rather, they are compounded, as each group is unable to achieve the allocation of gas that would occur in a purely competitive setting. These regulatory practices raise the following questions:

- o To what extent do different classes of consumers pay different prices for gas?
- o What assumption is made about how the new cost burden created by decontrol would be allocated among different classes of users?
- o If incremental pricing is abolished under a decontrol proposal, how will this affect industrial gas demand and, in turn, gas prices in the residential and commercial markets?

INCOME-RELATED CHANGES IN DEMAND:
THE LINK TO MACROECONOMICS

A final problem in the decontrol of natural gas is the relationship between the natural gas market and the aggregate level of economic activity. Natural gas takes up a large portion of some household budgets and of industrial and commercial costs in particular sectors. Thus, large increases in the price of gas could reduce the income of these households and the profits of these firms. Such households and firms would have to, in turn, reduce expenditures on other goods or inputs, resulting in a reduced level of total real spending. This initial loss of national income would cause a shift of gas demand, that is, less gas would be demanded at every possible gas price.

The potential reduction in gas demand is of consequence in estimating the benefits of gas decontrol. If gas demand dropped as a result of reduced national income, then the efficiency gain associated with gas decontrol would be smaller. This would happen because there would be fewer new gas users and efficiency gains are realized when new users foresake more expensive alternatives and switch to gas. Conversely, as national income grew (for example, as producers respond their revenues), the efficiency gains of decontrol would grow as well.

The central question here is the extent to which the decontrol of gas prices would have an income-reducing effect. If all households and firms were to react perfectly and instantaneously to gas decontrol, and if all factors of production were perfectly mobile and interchangeable, it is doubtful that such an income effect would occur. In the absence of such a perfectly fluid world, however, the existence and possible magnitude of an income reducing effect becomes worthy of concern. This effect depends on a variety of factors concerning responding of the revenues raised from decontrol and the speed of decontrol adjustments. Moreover, while this income effect might reduce gas demand and, therefore, the amount of income gas decontrol might redistribute, the size of the redistribution would play an important role in determining the magnitude of the income effect. Thus, the size of the income redistribution created by gas decontrol and the effect of gas decontrol on national income would be determined simultaneously. These macroeconomic issues are discussed in the next chapter.

The decontrol of wellhead natural gas prices would change relative prices, redistribute significant amounts of income, and promote efficiency in energy production and use. These adjustments throughout the economy would influence the level of national income and employment.

The economic effects of natural gas decontrol would cause adjustments in wages and prices and consumption and production activities. Higher gas prices initially would reduce consumer discretionary income and, unless offset by price reductions for other items, would reduce the amount consumers could spend on other goods and services. As consumers reduced their purchases of nonenergy goods and services, the producers who supply them might curtail their production and, in turn, their investment and employment levels. Nonenergy producers that use natural gas would also need to readjust their fuel and other input use in response to decontrol. In contrast, gas producers would recirculate their additional revenues in the form of higher taxes, payrolls, dividends, or investment. These shifts in the composition of consumption and output would initially reduce overall employment, output, and income. As households and firms reduced their natural gas consumption in response to higher prices, however, they would generate the efficiency gains discussed in Chapter III. These efficiency gains could eventually offset the output losses incurred during the initial stages of the adjustment period and could result in higher levels of national income, output, and employment.

The major macroeconomic consideration about natural gas decontrol, therefore, is whether the additional spending by energy producers and the efficiency gains generated by decontrol would lead quickly to greater economic growth. This chapter provides a macroeconomic context that describes how the timing and magnitude of these effects are determined.

THE ROLE OF NATURAL GAS PRICES IN ECONOMIC ACTIVITY

In a competitive economy unfettered by the constraints of time or resource mobility, increases in the price of natural gas would promote changes in the mix of economic activities and a more efficient use of resources. These higher prices would generate additional revenues in the gas industry that could be used to increase gas production by bidding capital, labor, and other productive resources away from other industries, just as

higher oil prices have stimulated investment and employment in the oil industry. According to this perfectly competitive model, the resulting shift in the mix of economic activities would maintain the overall level of output and employment.

Resources are never as interchangeable as they would have to be to obtain this immediate and complete adjustment, however. The mix of goods and services and the allocation of productive resources require time to adjust. Furthermore, prices and wage rates often do not reach levels that balance supply and demand. These features of the economy, therefore, lie at the heart of the timing and sequence of the macroeconomic adjustments under natural gas decontrol.

The macroeconomic effects of decontrol can be best understood by dividing the economy into three groups--consumers, nonenergy producers, and energy producers. Nonenergy and energy producers purchase input services (labor, capital, and energy) and make payments for these factors of production. These payments make up total personal income (wages and salaries and capital returns) and energy producer receipts. The output produced by nonenergy producers becomes the consumption and investment goods purchased by households and energy producers. These relationships constitute a circular flow of goods, services, and income and are affected by the response of all prices and wages to natural gas decontrol. The government and foreign trade sectors of the economy have been omitted here for the sake of simplicity. The inclusion of these sectors would not significantly affect the following qualitative discussion. 1/

Within the context of this circular flow, four major economic mechanisms appear to determine the macroeconomic adjustments under natural gas decontrol. First, there would be adjustments in consumer spending. Higher natural gas prices would reduce gas consumption as households switched to other less expensive fuel and used gas more efficiently. These adjustments would dampen the increases in the Consumer Price Index (CPI) caused by higher gas prices. Increased natural gas prices, however, would reduce consumer income available for purchasers of nonenergy goods and services. Lower expenditures on these items would translate into reduced demand for nonenergy products. As a result, nonenergy producers might

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1. Since this report is intended only to provide a background setting for understanding natural gas decontrol, it does not attempt to analyze probable quantitative macroeconomic changes. These are presented in a CBO companion paper, Natural Gas Pricing Policies: Implications for the Federal Budget (January 1983).

reduce their demand for labor and capital, which, in turn, would result in lower personal income.

Second, while nonenergy producers would reduce output and employment because of lower household demand for their products, they also would substitute other fuels and inputs for gas. These changes on the production side of the economy would limit the extent to which higher natural gas costs would be passed on to the next stage of production and, therefore, dampen the cost-push inflationary impact of decontrol. Input substitutions could also offset the output and employment reductions caused by declines in consumer spending and eventually lead to higher employment and wage and capital income. For example, nonenergy producers might increase their investment in order to replace or upgrade that portion of their capital stock made obsolete by higher gas prices. In sum, wages and capital returns would change as nonenergy producers adjusted their production processes to higher gas prices and their output levels to changes in general economic conditions caused by decontrol.

The third mechanism would be the respending of the additional income that energy producers received from nonenergy producers and consumers. This respending would take place as energy producers invested in new equipment and other assets, thus stimulating economic activity in the non-energy producing sectors. Additional stimulus would occur as energy producers hired more workers.

Finally, the flexibility of wages and prices would also be important. ^{2/} The response of wages and prices to natural gas price increases would be largely determined by the above three mechanisms. Price and wage flexibility would determine the inflationary effects of higher gas prices and, therefore, the level of real income and output under decontrol.

The ultimate macroeconomic effects of decontrol, therefore, would represent a balance of these three effects: the reduced consumption of non-gas goods and services, the drive by the producers of these nongas goods and services to adjust to changing demands for their products and higher gas prices, and the respending of new revenues by gas producers. The key to understanding this balance lies in accurately describing the behavior of these three groups of economic actors: consumers, nongas producers, and

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2. See, for example, Knut Anton Mork and Robert E. Hall, "Energy Prices, Inflation and Recession, 1974-1975." The Energy Journal, vol. 1, no. 3 (July 1980), pp. 31-63.

gas producers. The balance of this chapter provides these descriptions, and raises the major questions surrounding each of them.

CONSUMER DECISIONS

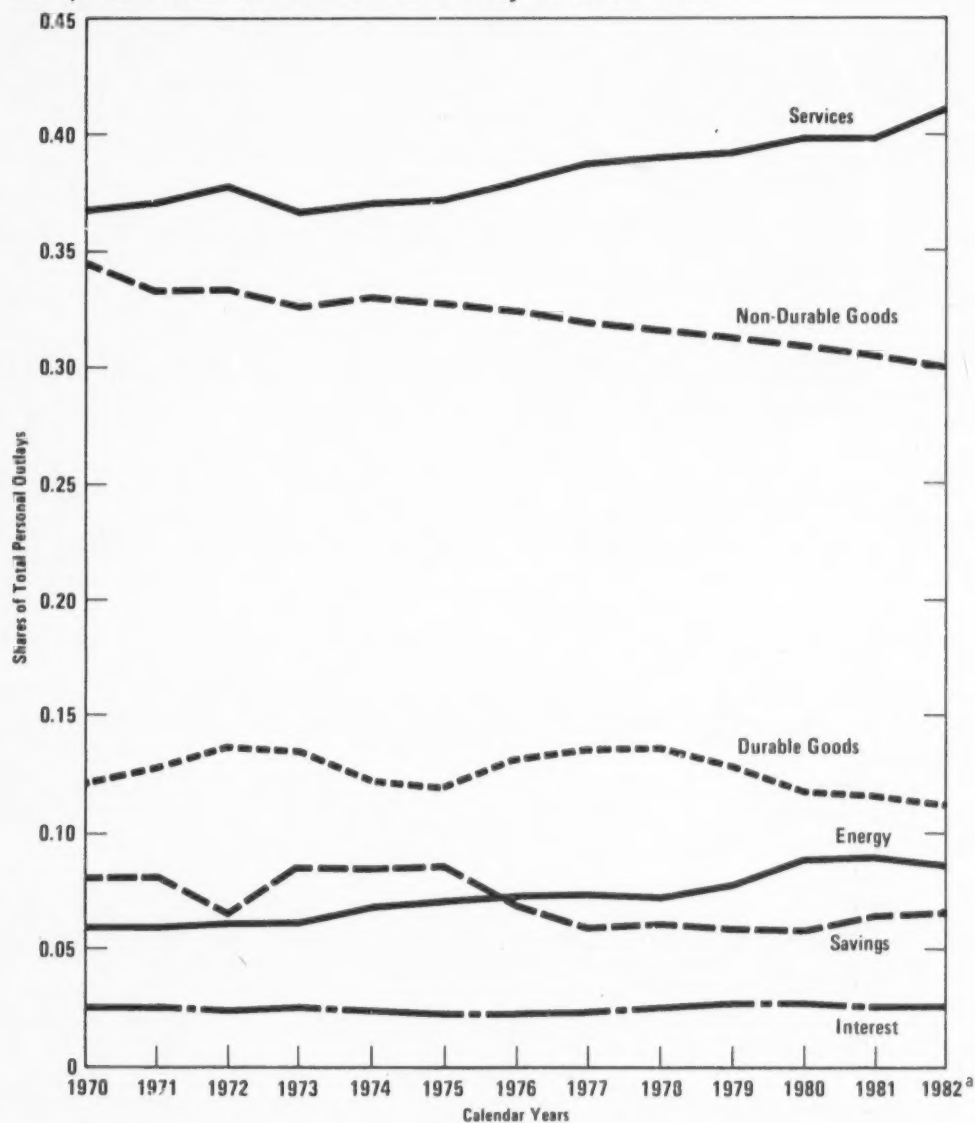
The allocation of total consumer outlays would be affected by an increase in real natural gas prices caused by decontrol. Given the historically observed inelastic nature of short-run energy demand, a rapid rise in natural gas prices would increase the share of energy expenditures in total consumer outlays. Since it is unlikely that household income would increase as rapidly as these expenditures, either savings or consumption of other goods and services would decline in the short run.

The composition of total personal outlays is illustrated in Figure 1 for the period 1970 to 1982. The share of energy expenditures increased 51 percent from 1973 (the first year of the OPEC oil embargo and dramatic jump in oil prices) to 1980. Also during this period, the share of expenditures devoted to services increased. The shares for savings and non-durable goods, however, declined during the post-embargo period. The time profile for the share of durable goods suggests some sensitivity to the energy share, particularly during the 1978 to 1980 period. The data illustrated in Figure 1 suggest that the rising share of energy expenditures may be partially responsible for some compositional shifts in total consumer outlays in addition to shifts in the relative prices for the various consumption items.

These shifts in the composition of consumption could affect employment and output. A reduction in consumption of other goods and services caused by higher energy prices would translate into lower receipts for these sectors of the economy. Lower business receipts in these sectors could lead to reductions in output and employment. The most likely category of consumption that could be reduced is discretionary spending on durable goods, such as automobiles and appliances, which are characteristically most sensitive to the levels of income available after purchases of "essential" goods.

A reduction in personal savings because of energy price increases would probably be short-lived, since aggregate savings rates are generally constant over the long term. If consumers financed their higher natural gas bills by reducing their savings, then the output losses attributed to shifts in consumer spending would be offset. Lower personal savings, however, would tighten capital markets and result in higher interest rates leading to lower capital formation and investment, reducing potential output and future productivity. Total personal savings have been observed to respond primarily to real disposable income. Higher natural gas prices effectively reduce the amount of goods and services a household can purchase and, thus, lower real

Figure 1.
Composition of Total Personal Outlays After Taxes



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis.

NOTE: Total Personal Outlays is a category of the National Income and Product Accounts.

^a Preliminary figures.

disposable income. Hence, the effect of higher natural gas prices on personal savings would operate through lagged changes in real income.

Any analysis of natural gas pricing policy must address the following questions about consumer behavior:

- o What assumptions are made about the response of consumers to higher gas prices? (Alternatively, what are the price and income elasticities of gas demand?)
- o How are the elasticities measured?
- o If consumer gas expenditures increase, for which goods will consumer spending decrease? How is this result obtained?
- o What assumption is made regarding the effect of higher gas prices on savings? On what basis is this assumption made?

NONENERGY PRODUCERS

Nonenergy producers purchase fuels from energy producers, hire workers, and borrow capital to produce goods used for final consumption or as inputs into other production processes. Workers, capital, and fuels are often termed "factors of production," and payments for them become household income and energy producer receipts. The elimination of natural gas price controls would, according to economic theory, promote substitutions among these factors in the production of nongas goods and services. The result would be a more efficient allocation of resources through which society could produce more goods with fewer inputs and, thus, earn more income. The key uncertainty is the speed with which these changes would generate higher personal income.

Factor substitutions represent the efficiency gains described in Chapter III. These substitutions are functions of the relative prices and the level of business activity that result from nonenergy consumption. As they occur, factor substitutions in the production process would translate efficiency gains into additional national income. This increased income could eventually offset reductions in planned output caused by the reduced consumption of nongas goods and services. In addition, efficiency gains would be realized as firms substituted other less costly fuels for natural gas.

This description of factor substitution raises questions concerning the responses of nonenergy producers under decontrol:

- o How do natural gas prices affect a firm's demand for labor, capital, energy, and materials? How is this effect estimated?
- o To what extent are other fuels substituted for gas in the production of nonenergy goods?

Changing Demands for Labor and Capital

The cost of production for nonenergy producers is influenced by input prices and the level of demand for their final products. Relative prices for labor, capital, energy, and materials affect the allocation of business expenditures. Assuming all other factors remain constant, a change in the relative price for an input will affect the allocation of business expenditures through two effects. The first--called "own-price" effects--is the simple law of demand--less of any good or input is typically demanded as its price rises. The second--"cross-price"--effects reflect the substitutability and complementarity between factors of production. If natural gas and labor are substitutes, then the quantity of labor demanded would increase with a rise in natural gas prices. For example, a manufacturer may hire an additional worker to monitor gas saving equipment. On the other hand, if they are complements, the quantity of labor demanded would decline with an increase in the price of natural gas. This would occur if a producer reduced his operation of some equipment to save gas and, therefore, reduced his work force.

In addition, changes in natural gas prices could also affect the utilization of the capital stock. The relationship between energy and utilized capital stock is subject to debate. If energy and capital stock are substitutes, then higher natural gas prices would increase the demand for capital stock. This could result in higher personal income (all other factors remaining constant) through investment which would increase dividends and capital gains.

A different rate of utilization of the capital stock could also affect investment in the nongas sector. If higher natural gas prices made a portion of the capital stock obsolete, then replacement investment might increase. Investment decisions, however, are often made on the basis of expected output, rather than the possible efficiency gains from substituting new capital stock for higher-cost energy.

If consumers reduced their consumption of nongas goods and services, increased replacement investment might not take place. When workers are hired or capital employed, businesses must make expenditures. The level of business expenditures depends on the demand for final products. Reduced

consumption, in turn, would reduce nonenergy producers' planned output or anticipated business expenditures. If producers did not anticipate the reduction in the demand for their goods correctly, unplanned inventories might accumulate. In either event, firms would seek lower levels of total costs and expenditures, including investments. Therefore, output effects would be important for determining the investment effects of decontrol.

Any analysis of the macroeconomic effects of decontrol, therefore, must focus on these questions:

- o How will higher natural gas prices affect the hiring of labor in the economy? Are labor and energy complements or substitutes?
- o To what extent will higher gas prices lead firms to replace their old capital or use less of their existing stock?
- o What, therefore, is the effect of higher gas prices on investment?
- o To what extent will firms reduce the amount of labor and capital they employ in response to possible lower levels of output that follow decontrol?

Fuel Substitutions

Shifts in the fuel mix could reduce the demand for imported fuels. This could improve the balance of trade and increase national income. Moreover, by substituting other fuels for gas, firms and households would reduce both the cost burden that decontrol imposed on the economy and its inflationary impact. The questions that must be answered regarding fuel substitution possibilities include:

- o What assumptions are made regarding relative fuel prices?
- o Do regulatory policies and institutional factors influence perceptions of long-term fuel availability?
- o Are there technological constraints that determine the feasibility and cost of fuel switching? How will these affect the economy's response to higher gas prices?

ENERGY PRODUCERS

Two important questions about energy producers' behavior under decontrol are: how much more gas would they produce, and when would they

produce it? These factors would determine the availability and cost of natural gas. If the supply of natural gas was not responsive to higher prices, then the economic adjustment costs could be substantial. The converse is true to the extent that higher prices bring forth generous supplies. Furthermore, since the lead times can run several years for new production facilities, the supply response is likely to be limited in the short run. This would be another source for transient adjustment losses.

The consumption and investment behavior of energy producers would be pivotal in the economic adjustments set in motion under decontrol. As natural gas producers received prices in excess of the costs of production, they would receive profits. These profits might be invested or distributed through dividends. The profits that enter the consumption expenditure flow would offset the reduction in consumption caused by higher gas prices. Investments in new plants and equipment would stimulate final demand and increase productive capacity. Natural gas producers also could invest these profits in nonproductive assets, which would erode the nation's ability to produce goods and services.

On the other hand, increased exploration, development, and production would increase employment in the energy industry. This employment stimulus and its associated impact on wage income must be weighed against the possible declines in employment caused by reduced consumer spending for nongas goods and services and by potential plant closings caused by capital obsolescence among nonenergy producers.

The composition of ownership in the energy industry would affect the recycling of energy revenues. If most of the revenues accrued to individual proprietors rather than multinational corporations, then a higher proportion of the revenues might stimulate consumer spending. Larger corporations might allocate revenues to retained earnings. These funds could then be used to finance projects in the United States or abroad, depending on corporate rates of return. The different propensities to consume and invest among various owners of energy resources would affect the rate of respending of revenues and ultimately the costs of adjustment.

Any analysis of gas decontrol, therefore, must address the following questions:

- o What assumption is made regarding the response of gas supply to wellhead decontrol or other price changes?
- o How will gas producers respense the revenues they realize through decontrol and how quickly will they respense it? How are these estimates obtained?

- o What new demands for labor and capital are created by gas industry responding?

WAGE AND PRICE FLEXIBILITY

The degree of wage and price flexibility under various natural gas policies would influence real income and output in the economy. The total impact of higher natural gas prices on the level of wages and prices would be composed of direct and indirect effects. First, higher gas prices would directly increase the CPI since natural gas is used as a heating fuel. Gas is also used to produce many goods and services, such as glass, chemical products, and processed foods. Thus, producer prices would increase as non-energy producers passed on at least some higher gas costs, depending on substitution possibilities. Prices for consumption and investment goods are, in turn, linked to these product prices. Therefore, higher producer prices would indirectly increase the CPI. Another inflation transmission mechanism set in motion by higher gas prices would be the wage-price link. Since many wage rates in the economy are either partially or wholly adjusted to reflect inflation, the first-round direct inflationary effects of decontrol would be augmented by a second round of indirect wage increases.

After estimating the impact that decontrol would have on natural gas prices, several other questions must be addressed to estimate the overall inflationary impact of these price increases:

- o What are the direct effects of higher gas prices on consumer and producer prices?
- o How are the increased producer prices transmitted to final product prices?
- o How will wage rates respond to the increases in consumer and producer prices caused by higher gas prices?

THE ROLE OF ECONOMIC POLICY

By understanding how consumers, nongas producers, and gas producers behave when gas prices rise, the macroeconomic effects of decontrol can be understood. The level and rate of increase in natural gas prices would largely determine the inflationary effects of decontrol and changes in relative prices that influence consumption and production decisions. The initial loss of purchasing power created by higher gas prices would result in reduced consumption of other goods and services. This would lead producers of those

goods and services to reduce their output, and, in turn, the amounts of labor and capital they would employ. By hiring less labor and by investing less, firms would lower the level of national income and perpetuate the downward movement of national income, output, and employment.

These trends would be reversed as the economy adjusted to higher gas prices. Consumers would reduce their gas consumption and adjust their spending on other goods and services in response to higher gas prices and the associated price increases for other goods. Firms in the gas industry would spend their additional revenues either by purchasing new capital equipment or by increasing wages or dividends. Moreover, firms that produce nongas goods and services would substitute other, less expensive fuels for gas and improve the efficiency of gas-burning equipment. Also during this adjustment process nongas firms might increase their employment and investment, as input substitutions occur and as consumer spending rebounds. All of these activities--hiring workers and investing in equipment to produce gas, substituting other fuels for gas and new equipment or labor for energy in producing goods and services--constitute the mechanisms that generate the efficiency gains discussed in Chapter III. These gains would allow the economy to produce more output with fewer inputs and thereby raise national income and product. Thus, after an initial period of dislocation that would reduce national income, output, and employment, the economy would begin to adjust and pave the way to higher output and employment.

All of these adjustments would take place within the context of federal economic policy. The conduct of monetary policy would be particularly important during the transition to a new gas pricing regime. The central question is: would the monetary authorities accommodate the higher level of gas prices that would follow decontrol? 3/

Allowing monetary policy to accommodate higher gas prices would have several effects. In general, such a policy would avoid an increase in unemployment at the potential cost of more inflation. Accommodating higher gas prices also would result in smaller initial economic dislocations, since some of the loss of consumer purchasing power would be compensated through easier credit and liquidity in the economy. This would result in smaller losses of income and employment in the short term.

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3. In response to higher prices, consumers might increase their demand for money. If the Federal Reserve Board allowed the money supply to grow to meet this demand, it would implement an accommodative monetary policy.

In the long term, however, such a policy could impose several costs. First, by risking inflation, an accommodative monetary policy could preclude price decreases in the nongas producing sector of the economy. Thus, in the long term, it might defer some of the inevitable adjustment in this sector. Moreover, to the extent that such a policy increased inflation, it would raise long-term interest rates. By doing so, it would retard the substitution of capital stock for energy by making capital more expensive. In this way, it might also defer the efficiency gains that gas decontrol would set in motion.

A nonaccommodative, or tight, monetary policy would work in the opposite direction. By risking more unemployment rather than more inflation and by reducing liquidity in the economy, tight money could make the immediate dislocation following decontrol more wrenching. But if such a policy resulted in lower inflation--by moderating the rate of price increase in goods and wages--it might offer better prospects for adjusting to higher gas prices. Specifically, if such a policy succeeded in lowering inflationary expectations and, in turn, long-term interest rates, it might facilitate the realization of efficiency gains and provide long-term economic benefits.

There is little consensus within the economics profession regarding the actual effects of monetary policy. Some claim that higher money supply growth raises the price level directly and that this inflation erodes any potential improvement in real economic activity. Others contend that higher money supply growth immediately lowers interest rates by increasing the supply of credit and that, although some inflation may ensue, real activity will expand as a result. It is not the purpose of this or any other analysis of the gas market to resolve this question. But for purposes of comparing analyses, the following questions must be addressed:

- o What assumptions are made with regard to the conduct of monetary policy during the adjustment period following decontrol?
- o What are the effects of alternative assumptions regarding monetary policy?
- o Through what mechanism--be it interest rates, inflation rates, or aggregate purchasing power--does monetary policy influence the economy's transition to decontrolled gas prices?

CHAPTER V. DISTRIBUTIONAL CONSEQUENCES OF DECONTROL

As the previous chapters have shown, natural gas decontrol might provide the economy with potential long-run gains in efficiency and possible short-run losses in output, employment, and income. Both the economic gains and losses are measured by the same indexes, which show the gains and losses to the economy as a whole. These aggregate indicators of economic movement do not satisfactorily describe changes in the distribution of income. Since the efficiency gains and macroeconomic adjustment costs could accrue unevenly, any analysis of the decontrol of natural gas must address its distributional consequences to be complete. In question is not merely whether society as a whole would be better off, but also how the effects of wellhead price decontrol could vary among regions, industries, and income classes.

Natural gas price decontrol would have two sequential sets of distributional effects. First, customers who were once able to obtain gas at the controlled price would pay more for that same gas, and producers who sold this gas at the controlled price would receive higher revenues. Second, certain industries and regions would change as the economy adjusted to a new set of higher gas prices and a different mix of goods and services. An increasing share of GNP would accrue to the natural gas industry, its ancillary industries, and the recipients of the economic benefits derived from greater gas availability. The share of other activities would fall. Gradually, firms, capital, and people would move toward those regions, industries, and activities that expanded in response to gas decontrol, and away from those that experienced a decline in rewards. This chapter discusses distributional aspects associated with these adjustments. The first section outlines the initial effects: who would be likely to pay or receive more. The discussion then turns to the second round of effects: how industries and regions might experience changes.

INITIAL DISTRIBUTIONAL EFFECTS

The initial distributional effects of natural gas decontrol can be analyzed in terms of industry revenues, consumer expenditures, and federal revenues.

Industry Revenues

If decontrol of natural gas prices resulted in significantly higher natural gas prices, an initial transfer of income from natural gas users to producers would occur. The amount of this transfer would be determined by reductions in gas demand caused by higher prices and the adjustment of the economy to decontrol (as discussed in Chapter IV).

Of all the groups in the natural gas industry, only natural gas producers would be likely to receive substantial new revenues under wellhead price decontrol. Distribution and transmission firms are regulated industries and have fixed (by the Federal Energy Regulatory Commission and state Public Utility Commissions) rates of return and prices. Unless the use of gas increased, they could not earn additional income under decontrol.

Natural gas producers can be divided into producer firms, which actually extract natural gas, and royalty owners, who typically own the land or the mineral rights to the land under which the natural gas is found. The new income from decontrol would initially flow to these two groups. Royalty owners typically receive 12 to 15 percent of the price of the natural gas, while producer firms, which have accepted the risks associated with exploration and development, receive 85 to 88 percent of the funds.

Producers of natural gas, as opposed to royalty owners, tend to be publicly owned corporations, often the major oil companies, and any additional income that natural gas decontrol could generate would either be distributed as dividends or reinvested. In either case, the stockholders would be the main recipients of the profits, either through dividends or increased stock valuation which could, if the stocks were sold, be translated into capital gains. Therefore, the ownership of stocks in these firms would largely determine who initially gains from natural gas decontrol. Since stock ownership generally increases with income, increased dividends or increased stock wealth would probably accrue to higher income individuals.

Royalty owners can be individuals, corporations, state and local governments, or the federal government. Royalty owners would receive more income as a result of wellhead deregulation of natural gas since royalty payments are generally determined on a gross receipts basis. In addition to receiving higher income, asset wealth of these groups would increase as the value of the mineral rights rose. The impact on the distribution of income would, therefore, depend on the distribution of royalty ownership. Of all privately held land in the Mississippi Delta and South Plains states, where three-fourths of U.S. natural gas is produced, roughly 70 percent is held by the top 5 percent of owners. Ranch and farmland in these regions is less concentrated, but the top 5 percent still

own roughly one-half of such land. Therefore, if private royalty ownership is distributed similarly to the ownership of land, from which it derives, then most increased payments to private parties would accrue to higher income persons.

Consumer Expenditures

In the event of natural gas decontrol, individual consumers would pay more in two ways: directly through higher purchase prices for gas, and indirectly through higher prices for all goods that use natural gas in their production.

Direct Expenditures. About 50 million households use natural gas, of which 45 million use it as their principal heating source. Between April 1980 and March 1981, residential expenditures on natural gas totaled \$19.3 billion. Overall, natural gas accounts for 30 percent of all energy use in the residential sector. Although among people who use natural gas as a heating fuel, the average expenditure was \$409 during this period, the amount varied widely by income class and region. Table 3 shows that higher-income classes spend absolutely more on natural gas than do lower-income classes, but that, as with other basic necessities, lower-income groups spend relatively more on natural gas as a percent of family income. This pattern is also true, although to a lesser degree, among households that do not use natural gas for heating.

Large increases in gas prices would reduce income available in household budgets for other uses. As could be expected, natural gas expenditures are much higher in the northeastern and northcentral states than they are in the South and West, because of variations in climate. Table 3 shows that the difference in home heating expenditures between the coldest and the warmest regions is more than two to one. As a percent of total residential energy use, however, natural gas usage is higher in the South and West than in the Northeast, principally because oil heat is still quite common in the Northeast and much more electricity is produced from natural gas in the South and West.

If natural gas prices are decontrolled, these cost patterns might not rise uniformly since each region has a different historical pattern of natural gas use. The Northeast, for example, is served by pipelines with proportionately more gas that is held to low prices under old contracts and the requirements of the Natural Gas Policy Act (NGPA). By contrast, the South has proportionately more higher-priced gas under new contracts. This regional disparity in endowments of low-cost gas might lead to the imbalances discussed in Chapter III--specifically, the inability of unendowed

TABLE 3. ANNUAL NATURAL GAS EXPENDITURES FOR HOUSEHOLDS:
APRIL 1980 THROUGH MARCH 1981

Households By Category	Number of Households (In millions)	Expenditures per Household (In current dollars)	As a Percent of 1978 Income
All Households	44.6	409	---
Ranked by 1979 Income			
Less than 5,000	5.5	368	more than 7.4
5,000 to 9,999	7.3	373	5.0
10,000 to 14,999	6.9	385	3.1
15,000 to 19,999	6.6	388	2.2
20,000 to 24,999	6.0	443	2.0
25,000 to 34,999	6.7	438	1.5
over 35,000	5.6	476	less than 1.4
By Region			
Northeast	6.6	618	---
Northcentral	15.0	472	---
South	11.8	342	---
West	11.1	269	---
Urban	37.9	410	---
Rural	6.7	399	---

SOURCE: Department of Energy, Energy Information Administration, Residential Energy Consumption Survey: 1980-1981 Consumption and Expenditures (September 1982).

NOTE: Details may not add to total because of rounding.

regions to compete for new gas supplies. Thus, depending on the way that wellhead decontrol is carried out, specific regions could see very different patterns of price increases. To the extent that delivered gas prices rise to the same level nationally, northeastern and northcentral customers, who have had less expensive gas, would be catching up with southern customers who have paid higher prices for years. In this event, consumers in the

northeast and northcentral regions, who also use more natural gas per household, would experience greater gas price increases than the national average.

If fly-up occurred, as discussed in Chapter III, then intrastate customers might pay higher prices than interstate customers. Since intrastate pipelines lack a cushion of inexpensive gas, they would not have a reserve with which to average the higher-priced marginal gas and so lower their overall prices. Since the interstate pipelines have this advantage, their prices would not rise to as high a level as those in intrastate markets. In sum, interstate gas customers might see bigger price increases, while intrastate customers may see higher prices, depending on the extent of the fly-up. These issues raise the following question: how do endowments of other, cheap gas affect gas prices by region?

Indirect Expenditures. The principal indirect effect of higher natural gas prices would occur through increased electrical bills. In 1980, natural gas was used to produce 15 percent of all electricity in the United States, making it the second major source of electricity after coal (51 percent). In fact, almost 20 percent of the natural gas used in this country produces electricity.

Electrical utilities, however, use natural gas in very different ways. Some, especially in the Mississippi Delta and the South Plains, use natural gas for baseload generation. In Texas, for instance, three-quarters of all electricity was produced by natural gas in 1978. In Louisiana, the figure was almost as high, while in Oklahoma over 85 percent of the electricity was produced using natural gas. In most states, however, natural gas is mainly used for peak-load units and thus their use of natural gas is much lower. In between are half a dozen states that use natural gas for 15 to 40 percent of their electricity generation, mostly in the South and West. The effects of decontrol on consumers would, therefore, depend on the state in which they reside. In general, electrical bills should not increase as significantly in the Northeast, where natural gas constitutes only a small fraction of utilities' gas costs, as in areas where natural gas is burned for baseload generation.

In Texas, Louisiana, Oklahoma, and a few other large gas-producing states, the situation is more complex. Their electric utilities are quite dependent on natural gas, but their intrastate natural gas prices are already relatively higher than the national average. To the extent that the price of natural gas rose above its present level under decontrol, and especially if fly-up occurred, utility customers in those states could face significantly higher electrical bills. In other states, where utilities burn a large amount of interstate natural gas--for example, California and Florida--their customers may also end up paying significantly larger electrical bills.

Effects on Federal Revenues and Expenditures

Royalty Increases. Roughly 30 percent (5.67 trillion cubic feet) of U.S. natural gas is produced on federal lands, making the U.S. government the largest single royalty owner. Since wellhead deregulation of natural gas would increase the value of all royalty payments, including those accruing to the federal government, Treasury revenues would increase directly under accelerated decontrol. The current value of federal royalty payments is \$2.9 billion; the extent to which this figure would increase would depend on the specific nature of decontrol policy. The increased revenues would accrue to the Treasury, where they would be merged with other federal receipts. If these increased income flows were respent quickly, they would not contribute to the decline in aggregate output discussed in Chapter IV.

The increase in the value of gas and the consequent rise in severance tax revenues might prove troublesome for revenue-sharing programs. Some revenue-sharing programs base each state's allotment on the state's tax efforts, and state royalties are included in the state's "effort." Thus, an increase in tax receipts from royalties might result in more money being allocated to some gas-producing states without any real increase in their tax effort. To change this redistributive effect would require Congressional action on the treatment of increases in state gas royalties for revenue-sharing purposes. Since oil prices and oil severance tax revenues have already risen, the Congress might wish to address this question under any circumstances.

General Revenues. The deregulation of wellhead natural gas prices would have two rounds of effects on general federal revenues. In the first round, income tax collections, independent of any new excise or other natural gas tax the Congress might impose, should rise as the new natural gas revenues are taxed. Natural gas producers, gas stock owners, royalty owners, and firms producing goods and services for the industry would have larger income tax liabilities. These larger revenues would be offset only by the increased expenses of businesses that use natural gas; increased household expenditures on natural gas would not lower individual tax liabilities.

The second round of effects, however, might lower federal tax receipts if the income effects discussed in Chapter IV lowered aggregate economic activity. But even if aggregate economic activity did not decline, federal revenues might decrease if producers and others at the receiving end of the income flows had a lower effective tax rate than did the economy as a whole.

Decontrol would also change federal outlays. By changing the rates of unemployment and inflation, decontrol would require changes in the level of indexed transfer payments and of means-tested income support programs. The effects of decontrol on net federal revenues, therefore, would ultimately depend on its macroeconomic effects.^{1/} Any analysis of gas decontrol must ask: how does decontrol affect federal revenues and outlays? What macroeconomic effects contribute to these budgetary influences?

CHANGES IN THE COMPOSITION OF THE ECONOMY

As outlined in previous chapters, the income transfers that probably would accompany decontrol would have significant effects on aggregate economic activity. In the short run, consumers might reduce other discretionary spending since they would pay higher natural gas bills. This could have significant effects on industries whose demand depended on this discretionary spending. The relative values of natural gas and all other goods would shift in favor of natural gas producers. This shift would, in turn, increase the share of GNP claimed by industries in the natural gas sector at the expense of the other sectors of the economy. Unlike the decline in consumer demand, this shift in the composition of GNP shares would not be temporary. The relative value of output of the affected sectors vis-a-vis the natural gas industry would be permanently depressed.

Since the revenues of the natural gas industry would rise, resources, capital, and labor could be expected to move into that sector and out of the sectors whose incomes had been reduced. Barriers exist to slow the free movement of resources into some sectors and out of others, however, and different resources move at different rates. Thus, even within the sectors experiencing a relative decline, some factors of production might experience a greater decline than others because of institutional and other constraints to movement. For example, financial capital could move relatively quickly into the natural gas sector, but fixed assets could only be liquidated slowly and not necessarily at long-run full value. In the meantime, the return to financial capital would have increased while that of physical assets would have further decreased. Each sector of the economy, therefore, would be likely to experience a different constellation of effects.

1. For details, see CBO, Natural Gas Pricing Policies: Implications for the Federal Budget.

This section outlines the probable second round effects of natural gas decontrol on the gas-producing sector; other industries, and the long-run distribution of income.

Natural Gas-Producing Sector

The energy-producing sector would experience an increase in revenues from natural gas production. Energy producers would gain first, but inevitably some of its increased revenues would flow to ancillary gas industries as producers sought to expand their capacity. Service industries would also receive some of this additional income, as added wealth and income produced demands for a larger and broader array of goods and services.

Growth in the energy producing sector would probably be asymmetrical, however. If the experience of the oil industry under rising prices is repeated, it can be expected that gas distribution and marketing industries would experience stagnation and even decline, in spite of production increases. Table 4 shows that total employment in the oil industry has risen by one-third from 1973 to 1981, the period of rapidly escalating oil prices. But a closer look at the numbers reveals that the distribution and retailing segments of the industry have been stagnant. Wholesale and retail dealer employment has exhibited no significant change. Employment in service stations decreased by 8 percent, although this may have resulted from the increase of self-service gasoline retailers. Even oil pipelines have experienced no large increase in employment in absolute terms, which suggests a period of stagnation, considering that the Alaskan pipeline was built during this period. Outside the production segment, only petroleum refining, which is in an intermediate position between production and distribution, has seen any increase in employment.

In oil production, however, the growth has been large; extraction employment has almost doubled. Furthermore, those sub-industries that support production activities have seen the highest growth. Oil and gas field services have nearly tripled, while employment in the production of rigs and other capital inputs has more than doubled. To the extent that employment can serve as a proxy for other economic activity, this table indicates a large shift in activity toward oil production and, relatively, away from distribution.

If this same trend occurred in the natural gas industry, employment might not increase in gas transmission and distribution industries upon decontrol. Increasing final prices might produce a decline in gas sales for some pipelines, which could prove quite costly for some of them, given

TABLE 4. EMPLOYMENT IN THE OIL INDUSTRY (By fiscal year, in thousands of workers)

	July 1973	July 1974	July 1975	July 1976	July 1977	July 1978	July 1979	July 1980	July 1981 ^a
Oil and Gas Extraction	136.6	147.8	164.6	170.5	179.9	183.4	202.9	231.9	267.8
Oil and Gas Field Services	134.0	150.0	178.2	197.1	234.7	245.0	279.4	335.8	407.2
Oil Pipelines	19.1	17.1	17.0	17.2	17.1	19.7	20.5	22.5	23.2
Petroleum Refining	149.7	158.1	159.1	159.1	164.4	165.7	167.5	167.8	172.3
Petroleum and Petroleum Products (wholesale trade)	NA	NA	NA	NA	NA	228.3	227.9	224.7	226.9
Service Stations	616.8	625.8	622.3	631.8	625.7	652.9	546.7	566.3	563.7
Retail Fuel Dealers	98.7	97.7	95.5	95.1	95.0	96.4	100.7	100.7	100.7
Oil Field Machinery	49.3	50.7	66.4	68.4	73.0	77.2	86.1	93.8	111.7
Total ^b	1204.2	1247.2	1303.1	1339.2	1389.8	1440.3	1403.8	1518.8	1646.6

SOURCE: Bureau of Labor Statistics, Employment and Earnings, various years.

NOTE: NA = not applicable.

a. Preliminary.

b. Total does not include petroleum and petroleum products in wholesale trade because data prior to 1978 are not available.

distribution and transmission companies' high level of fixed costs. Other distribution and transmission firms might benefit from the construction of new pipelines and networks, however, since their rate of return is determined on undepreciated capital stock, rather than the volume of gas passing through their facilities. To the extent that price decontrol eliminates curtailments, new customers might be allowed to hook up. If these new customers needed new pipelines or distribution networks or large extensions of the old ones, distribution and transmission companies could add to their rate bases. If whole new subdivisions or industrial parks were allowed to connect up, this might be a significant addition to any single company's rate base. It should be noted, however, that this would be a period of decreasing, not increasing, demand because of higher prices.

Table 4 also indicates that growth in employment in the oil and gas field and equipment industries took time. For example, employment tripled, but over eight years. Significant delays might mean that industry growth would not be large enough to counterbalance the decline in consumption and nongas production discussed in Chapter IV. But because of the recent slump in the oil production industry, equipment and labor might be available in the region and industries that would expand following gas decontrol, thus reducing delays in growth.

If this pattern of growth occurred in the gas sector, most of the new employment and output could be concentrated in the natural gas-producing regions, while the distributive segments of the industry, which are scattered nationwide, would not benefit as much. The regional concentration of expanded employment could also apply to ancillary industries, most of which are necessarily near the gas wells. For example, over 80 percent of employment in the oil field machinery industry, which produces most of the equipment needed for drilling gas wells, is in the three leading gas-producing states. The major exceptions to this tendency are pipe companies. Oil and gas wells account for 40 percent of all pipe used in this country. Most of that pipe is produced in the Midwest and East, where very little gas is produced. This industry is relatively small, however, employing slightly more than 30,000 nationwide. Even a large expansion of the pipe industry would not raise total employment significantly. Any analysis of gas decontrol must ask: how does decontrol affect the level of employment in the gas industry?

Nongas-Producing Sectors

The nonenergy-producing sectors would be affected by natural gas price increases in two parallel ways. First, the costs of a major input--natural gas--would have gone up and the ability of any given firm to

pass along that cost would depend on the demand conditions it faces. To the extent that costs could not be passed through, profits would drop. Since, in the aggregate, nonenergy-producing sectors would lose income, these industries would have to determine how the losses would be divided. Second, even in sectors that were not major consumers of energy, the macroeconomic effects of natural gas deregulation could entail a loss. If consumers, feeling a loss of real disposable income, reduced consumption of nongas goods, then industries could experience declines in demand, independent of their cost increases. This raises the following question: how much employment would be sacrificed outside the gas industry because of macroeconomic effects?

Gas-Using Industries. In addition to higher utility bills under decontrol, consumers of natural gas would pay higher prices for all goods whose costs included natural gas. For example, natural gas, not including the electricity produced by it, accounted for 30 percent of all energy used by industry in 1978. In the commercial sector, natural gas accounted for over 20 percent of the energy used in 1978, again not including the electricity generated from natural gas. Since it constitutes such a large fraction of the energy used in the production of goods and services, many price increases could be expected if the price of natural gas rose.

Some price rises might be tempered by fuel switching, as industrial users change from natural gas to alternatives, such as electricity, coal, or number six fuel oil. Since many commercial and industrial firms, however, would have limited alternatives, they would have to pass on the higher gas costs or absorb them.

Apart from firms that could switch fuels and those few low-cost firms in competitive markets, however, the bulk of firms would in all likelihood raise their prices. The extent to which the incidence of higher prices would be passed forward would depend on the relative importance of natural gas in their total costs and, in the long run, possibilities for conservation or fuel switching. In most industries, energy costs represent only a small fraction of the final cost, typically as little as 5 percent. Even in the gas utility industry, gas costs are only 45 percent of final costs to customers. Thus, any one price increase is not likely to be large.

Large industrial gas users might benefit from the increased availability of gas resulting from wellhead price deregulation. The extra gas on the market would result in fewer and more predictable supply interruptions, which are costly and disruptive. In any event, depending on the details of the deregulation plan, large industrial users might have more leverage with gas utilities and transmission companies so that they could receive more compensation for interruptions than they now do. This potential realign-

ment in supply is an example of the efficiency gains outlined in Chapter III, as previously unmet demands are satisfied.

Industries whose costs have risen might be affected in several ways. They could be threatened by foreign imports whose costs had not risen. Depending on the elasticity of demand in their markets, industries might or might not be able to pass on the new cost. If they could, the quantity demanded might decrease and create excess capacity in the industry. If they could not, the industrial rate of return would decline, which might lead to disinvestment in the industry.

Regionally, all gas-using industries would be affected by decontrol. For example, the chemical and petrochemical industry which is a heavy user of gas (five of the top ten gas-using industries are in this category) tends to be concentrated in the southcentral region. Since much of the industry draws gas from the intrastate market, firms have already adjusted to somewhat higher prices for natural gas. On the other hand, blast furnaces, smelters, metal refiners, and glass industries, which also consume large quantities of natural gas, tend to be concentrated in the eastern and northcentral regions, where gas prices now are lower, but might rise upon decontrol.

Nongas-Using Industries. Even if an industry does not use much gas, it might be affected by increased natural gas prices in two major ways. First, the cost of its inputs, might rise because of cost increases in other industries or, more important, because of increased wage demands as workers seek to maintain their real wages. Second, as outlined above, the transfer of income from consumers to producers would cause a decrease in aggregate demand in the short run. Since consumers would experience a decrease in real income, it is most likely that consumer expenditures, particularly on consumer durables, would decline. Consumer durable industries, like automobiles and their ancillary industries--steel and rubber--might be adversely affected even if they are not gas intensive. Since these industries are geographically concentrated, slowdowns in their activity would inevitably engender decreases in income and employment in specific cities and localities, as the ripple effects made themselves felt.

Regionally, the decline in demand for consumer durables would probably affect the northcentral area most heavily, since these industries are concentrated in the steel belt. The regional effects of increased wage demands are more difficult to sort out.

Long-Run Redistribution of Income Between Capital and Labor

In the long run, the different sectors of the economy and regions of the country would adjust to new natural gas prices as capital stock was turned over and as labor markets adjusted to new circumstances. Adjustment to new relative prices entails a new long-run redistribution of income. Thus far in this analysis, this redistribution of income has been examined from a regional, industrial, and sectoral perspective. In this section, the effect of natural gas decontrol on the division of national income between labor and capital is explored.

The distribution of national income between labor and capital would be determined by how these two factors of production are either substituted for, or used in conjunction with, energy in the production of nonenergy goods, and how they are employed in combination to produce energy.

Substitution Away From Gas. Those manufacturers, residences, and others that used gas prior to wellhead price decontrol would probably reduce their consumption of gas as its price increased. If users wanted to maintain their present level of output or comfort, however, they would have to substitute other things for gas. For example, to conserve natural gas, a household can merely turn down the gas, but if a warm home is desired, insulation and weatherization must be substituted for the natural gas. Similarly, a firm can buy new machines that produce more output or give more service per unit of gas consumed. In both cases, the gas users are substituting new capital for gas.

Labor's share of total national income, however, would be affected by the ability of firms to replace energy with labor--not capital. The natural gas price increase would mean that a larger portion of any firm's income would be spent for natural gas or for capital equipment to save natural gas. Unless the firm could substitute labor for energy or energy-using capital equipment, labor's share of that firm's income would decrease. In the past, firms have tried to save on labor, and the ability of firms to reverse this trend is questionable. Economists are divided as to whether labor would be substituted for gas in the long run. Such substitution can happen in the short run, and some economists argue that labor and energy are short-run substitutes, but long-run complements. Most economists feel, however, that all inputs are substitutes in the long run.

Movement into Gas-Producing Sectors. On average, the natural gas-producing industries are more capital intensive than is the economy as a whole. Should the industry expand, however, it would probably not remain at its current capital-to-output ratio. Since this industry probably would become only more capital intensive during expansion, moving more re-

sources into it would increase capital's share of industry expenditures, and, therefore, national income. The easiest areas in which to find and produce natural gas are already being exploited. Expanded exploration and production would require, therefore, deeper and more difficult wells, which, unless well-drilling technology changes radically, would mean more capital-intensive drilling.